PUBLIC WORKS

An Engineering and Construction Journal

City County State

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Brainteasers

When asked to reduce the prices of his wares, one bootlegger was reported to have aswered, "It's all this cutting that's ruining the business; I really should charge more to come out even."

At any rate his business should not have suffered as much as he would like to have made known. As we understand bootleg cutting, it goes something like this: Let $100 be invested for an original supply of liquor. Then add water. Mix well and sell as much of the mixture as necessary to retain a supply equal to the original amount, at a price of say $7 per gallon. Again add water, mix and sell as before. The value of original liquor in the remaining mixture is now 5 percent of the profit, and in dollars, equal to 20 percent of the number of gallons of liquid handled. Problem: How much, per gallon, was the unit price paid by the bootlegger for original supply?

Don't Get Dizzy:

As a companion to the above, here is one borrowed from Mr. Dudeney, who found time for reflection while being transported up and down on a moving stairway in the London Tube Railway. He says, ". . . I find that if I walk down twenty-six steps I require thirty seconds to get to the bottom, but if I make thirty-four steps I require only eighteen seconds to reach bottom. What is the height of the stairway in steps? The time is measured from the moment the top step begins to descend to the time I step off the last step at the bottom on to the level platform."

Last month's painter problem didn't worry anyone familiar with the science of mechanics. The painter's tug was enough to support one-fourth of the combined weight of himself and the plank. Solutions for the compass problem are being withheld so that those who haven't yet tackled it, may experience the thrill of finding one. There are believed to be at least forty different correct ways to solve it.

Oh, Yeah?

There should be a problem lurking somewhere in the word unhypersymmetricoantiparallelepipedicalisationalographically, which contains 60 letters and is submitted as the longest word in the English language —and used in mathematics. What a word for stutterers. And what an argument for shorthand. To us it's a challenge for a problem. The challenge is hereby extended to our readers.

BENJAMIN EISNER.

(We are indeed pleased to find such a wide response to this section designed for the less serious moments of life. Not only is this shown by the many letters we receive, but also by the re-appearance of these "Brain Teasers" in other technical journals, in advertisements and in house organs—not to mention newspapers.—Editor.)

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This country needs enough Water Works Construction to give WORK to *a million men*

Experts calculate that to produce and lay 100 tons of cast iron pipe requires a full day's work by 740 men. According to an unemployment relief plan sponsored by the American Water Works Association, the tonnage of cast iron pipe required for necessary water works improvements such as extensions, replacements and reinforcing mains is very large. To produce and lay the estimated tonnage would give a million men work for nearly a month. For, besides local labor, seven industries are primarily involved in the production, laying and transportation of cast iron pipe.

* * *

The Emergency Relief and Reconstruction Act authorizes loans for self-supporting public construction such as water works improvements. Municipal water works departments are more than self-supporting; they are almost invariably profitable operations. Improvement costs can be liquidated out of the departments' earnings without adding to the tax burden.

* * *

It is therefore to the advantage of any community to reduce the expense of direct unemployment relief, and to stimulate business revival, by constructing needed water works improvements now. To do so in time to affect the relief problem this winter calls for prompt action. Funds must be provided for, in some cases, through the Reconstruction Finance Corporation; bids advertised; materials produced and delivered — and all this will mean a race against winter breadlines.

* * *

Cast iron water mains are the most economical because they last longest. Their useful life is more than a century. They serve long after the bonds issued for their payment are retired and forgotten. Their long life is due to effective resistance to rust. Cast iron is the one ferrous metal for water and gas mains, and for sewer construction, that will not disintegrate from rust. This characteristic makes cast iron pipe the most practicable for underground mains since rust will not destroy it. For further information regarding cast iron pipe for water and gas mains, and for sewer construction, write to The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 122 S. Michigan Avenue, Chicago, Ill.

Look for the "Q-check" symbol as shown above. It is the registered trademark of The Cast Iron Pipe Research Association.

Besides local labor, these seven industries are involved in the production, transportation and laying of **CAST IRON PIPE**

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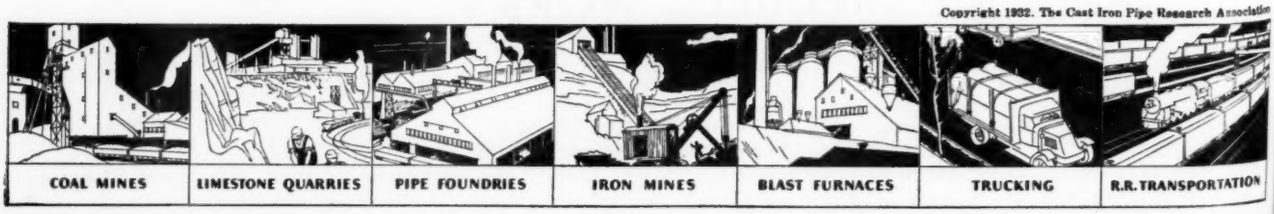


Do you need the latest catalogs? Consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 61.

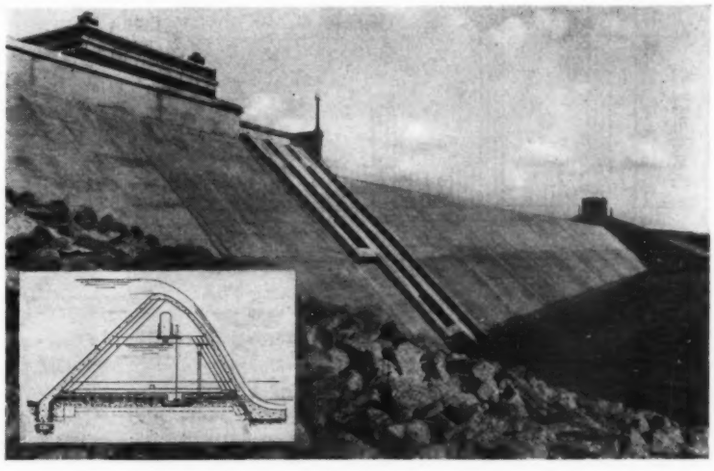
PUBLIC WORKS

City, County and State Engineering and Construction

Vol. 63 *September, 1932* No. 9

The Water Wheel

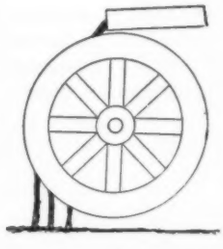
The essential features of important articles of the month having to do with water works design, construction and operation and water purification. Published every month.



The Clinton, Oklahoma, dam, showing intakes to purification plant
Insert—Cross section of coagulation basin inside the dam.

DAM Construction—Construction methods on dams reported include belt conveyors[19] and tower hoists for placing, in a dam in the Alps, 188,000 cu. yds. of concrete produced in a continuous stream by railway, aerial tramway, crushers, screens, batchers and mixers; 2600 feet of 30-in. belt conveyor delivers earth for a rolled earth dam, to be distributed and rolled by motor equipment at the rate of 10,000 yards a day;[10] and a cut-off trench for the Prettyboy (Baltimore) dam is cut 10 to 15 ft. deep in rock by means of wire saws and quartz sand,[11] at which dam belt conveyors for placing concrete have been replaced by gasoline locomotives operating on a wooden trestle.[66] Incidentally, unsuspected rotten rock at this dam site has increased the amount of excavation from 70,000 cu. yd. to 400,000, and the cost from $996,000 to $2,500,000.

Dam Design—The rear of a buttress dam looks like a row of buildings with the fronts off. Why not use them as buildings, instead of erecting separate buildings for installing the hydro-electric machinery or water purification plants? That is what has been done in a few installations.[8] The Clinton dam, in Oklahoma, 380 ft. long and 32 ft. high, contains in its cellular spaces the filter beds, coagulation basins, tanks and other structures required for purifying 2 m. g. d. of water. The Illchester, Maryland, dam over the Patapsco river houses three 500 h.p. turbine generators. Davis and Hudson, of the Ambursen Dam Co., show in this article that it costs no more to build such a dam with heavy buttresses spaced widely apart, thus giving more room for such equipment.



Masonry is slightly elastic and masonry dams deflect slightly from the pressure of the retained water. Dr. Fred A. Noetzli[9] has measured with great accuracy the deflection of an arched and a gravity dam in Switzerland, and finds small (¼ in. or less) but permanent deflections, even at the point of contact with the foundation. Periodic measurements might serve to give advance notice of impending failure. This might be used by State authorities in the supervision of dams, which supervision is generally recommended by members of the American Society of Civil Engineers who contributed to a symposium on the subject.[68]

Two years of uplift pressure measurements at Gibson Dam show absence of such hydrostatic pressure at construction joints and only nominal pressure at foundation levels.[22] Measurements at other dams, however, show pressures greater than these. Data on such pressures are requested by a committee of the American Society of Civil Engineers.[17]

The use of large (8-in. maximum) aggregate and minimum water which will give workable concrete in dam construction was found by Herschel H. Allen[74] to reduce shrinkage and reduce the cement used by 15%; but proper consolidation of such concrete required use of electric vibrating puddlers. All ingredients were proportioned by weight and the weights of each batch recorded graphically.

Corrosion of Mains—North America and South Africa contribute to the literature on corrosion of cast iron water mains. Mr. White,[77] city engineer of Bloemfontein, found a 20-in. main reduced 30% in delivery by incrustation, improvement by scraping practically disappearing in a year. Tests, both laboratory and service, of many kinds of bitumen coatings convinced him that many were useless, and that cold applications were more successful than hot. He advocates spraying rather than dipping, and sprays 600-ft. lengths of scraped mains by means of a spray nozzle on a bitumen container drawn through the pipe, to which compressed air is furnished

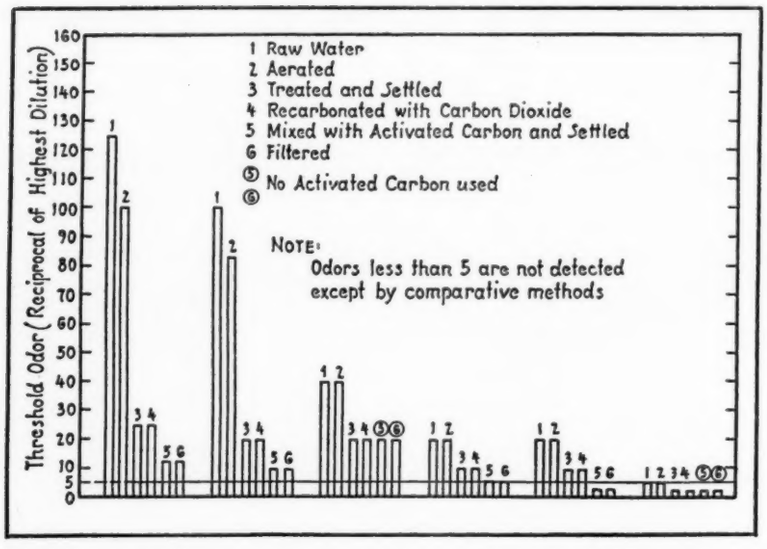


Fig. 1. Odor Removal at a Water Softening Plant. Bloomington, Illinois.

through a hose; the main being first dried of moisture by means of an air blast.

Cement lining is suggested by Reddick and Linderman[49] because alkaline iron-bearing water will not tuberculate while a slightly acid water will. Their paper is especially interesting because presenting data to prove that tubercles are formed by bacteria, such as crenothrix, leptothrix, gallionella and spirophyllum. "It is known that bog ore is formed largely by bacteria"; in chemical analysis, tubercles from several cities are found to resemble bog ore; and the bacteria named abound in tubercles. The tubercles are formed from iron in the water; therefore iron used for coagulating purposes may be detrimental. But the bacteria "must have a minute spot of bare iron where the iron concentration is high so that they can secure a footing" and organic matter for food. It would seem that the ammonia-chlorine treatment would kill these bacteria and thus prevent tuberculation. Malcolm Pirnie reported analyses showing iron left in 12 miles of 24 in. pipe at the rate of 7 to 9 tons a year. Mr. Van Giesen,[26] discussing corrosion as a result of chemical reactions and electromotive force, considers the pH of great importance but does not even suggest the agency of bacteria.

Water Shed Run-Off—"Scientifically determined facts apparently do not warrant the development of forests solely for the conservation of water supply. In regions where such supply is a controlling economic factor, careful study is needed to determine whether the value of increased water supply and better sustained minimum flow which are shown to obtain without forests does not outweigh the benefits of lowered normal flood flows and decreased erosion produced by forests, especially if these benefits can be obtained by shrubs or other small growth without the loss of water occasioned by forest growth." This conclusion[67] is based on measurements made by the U. S. Forest Service and Weather Bureau on areas in Colorado and California for several years before and after denudation thereof, the annual yield during the latter period having been 15% and 29%, respectively, greater than before.

"Although stream flow records in New England have been accumulated over a long period of years, very little attempt has been made to study the influence of forests and other forms of vegetation on the stream flow,"[50] says the director of the Northeastern Forest Experiment Station. "In this section of the country interest will center chiefly on problems of water supply for municipal use and for power." "Prof. G. F. Warren of Cornell, one of our foremost land economists, ranks forest use values about as follows: recreation, scenery, hunting and fishing, stream flow, city water, and, finally, lumber and other forest products."

A district engineer of the U. S. Geological Survey recently has directed attention[62] to the desirability of obtaining long and continuous records of stream flow, which serve various and often unsuspected purposes. "Little did I dream, when gaging the Delaware river at Port Jervis eighteen years ago, that the record would furnish the base data for adjudication of water rights between three states in a suit developing out of New York's dire need for an adequate water supply."

Ground Water.—Estimating the amount of ground water available is one of the most difficult problems presented to the water works engineer. "The most formidable difficulties result from the complexity of the texture of the water-bearing formations, which make it hard to get reliable figures for their two properties of chief significance—specific yield and permeability. . . . The chief instrument of precision in groundwater hydrology is the water-stage recorder installed over a well."[89] Mr. Meinzer, in the report quoted from, discusses at length the methods employed for estimating ground-water supplies.

Purification is making more advances and receiving more attention than any other feature of water supply activities. Of 90 articles listed this month, 22 are devoted to some phase of this subject, ranging from general articles reviewing the present status of different features of treatment [58, 73, 76] to highly technical descriptions of analytical methods.[31]

"No method of *measuring odors* has been in general use," says Charles H. Spaulding,[35] although odor in water is highly objectionable to consumers. He has developed a method for water works use which "consists of finding the highest dilution of the unknown which can be differentiated from odor-free water. If the dilution is 1 to 25, then the odor is 25. . . . It usually takes several days to get a nose broken in, figuratively speaking, but after that there seems to be no wide divergence in results by different observers. . . . The effect of various steps of purification on the odor of the water as it passes through a softening plant can be clearly seen by reference to figure 1." The treatment comprises use of lime, ammonia and chlorine. "The quality of odor is not touched by this yardstick. One odor of 10 may be more disagreeable than another of the same numerical value."

Taste eradication is the aim of elaborate equipment in a recent plant at Weiser, Idaho.[41] The water is aerated through filtros plates, [*Continued on page 48*]

Bleaching Clay In Water Purification

A chemist suggests the use of this material in removing color, tastes and odors, phenol, acids and bacteria, without adding any chemical characteristic to the water. It also improves coagulation effected by aluminum sulphate.

Excavating bleaching clay in Georgia

ADVANTAGES of the use of bleaching clays in treating water for the removal of tastes, odors, color, bacteria and acidity were set forth and discussed by Edward M. Slocum, Ph.D., consulting chemist of the General Reduction Co., of Macon, Ga., in a paper before the Pennsylvania Water Works Operators' Association, of which paper a brief abstract is given below.

"Bleaching clay," said Mr. Slocum, "removes unpleasant characteristics from water by removing the substances causing them. Its use does not impart any chemical characteristics to the water that might be disagreeable. To remove unwanted material from water by a natural, untreated substance, as a clay, does not produce any unpleasant psychological reaction in the mind of the consumer.

"Bleaching clay has the capacity to remove traces of phenol from phenol-contaminated water.

"Bleaching clay shows considerable capacity to remove chlorine and sulphuric acid from water containing these chemicals.

"Bleaching clay with aluminum sulphate forms a heavy floc which settles rapidly.

"Bleaching clay itself has bactericidal properties. With prechlorination, the great capacity of the clay to take up chlorine brings about more effective sterilization and reduces putrefaction and bacterial proliferation in basins and filters to aminimum.

"The economies possible in lessening the amounts of lime and other chemicals needed reduce the cost of using bleaching clay.

"Seven to ten cents a million gallons (¾ of a cent a pound), for a few pounds of bleaching clay used regularly, even when there are no serious color or odor problems, will be well spent as insurance against variability and possible trouble. The more unwanted substances are removed from the water supply, the less chance dissatisfaction will arise."

Explaining the action of clays in water he said: "Where colloidal dispersions of clay are present in water containing dispersed particles of protein material and bacteria, most of the colloidal organic material and bacteria are held by the clay particles. Hence the purification of the water from organic contamination may be as much due to the clay present as to the aluminum hydroxide (when aluminum salts are added). The ability of muddy rivers like the Missouri, Arkansas and Mississippi to quickly assimilate pollution is well known."

Bleaching clays are characterized by their marked capacity to absorb colored and odoriferous substances, and their high water content. As placed on the market, bleaching clays have only 20 per cent of the amount of water naturally occuring, and the remaining 80 per cent of the potential surface reaction is available for many other reactions. This accounts for its capacity to remove color from water or oil and taste from edible fats and oils. Unlike many other substances used for removing tastes and odors, bleaching clays are very inert to chemical reagents and contribute nothing to the water.

Most odors and tastes in water are due to oils, and the efficiency of bleaching clay for removing them is remarkable—it will hold 40 per cent of oil so firmly that even blowing the clay with live steam will not remove it. Such odors as are due to gases are probably better removed by carbon, as clay shows no great selectivity for gases.

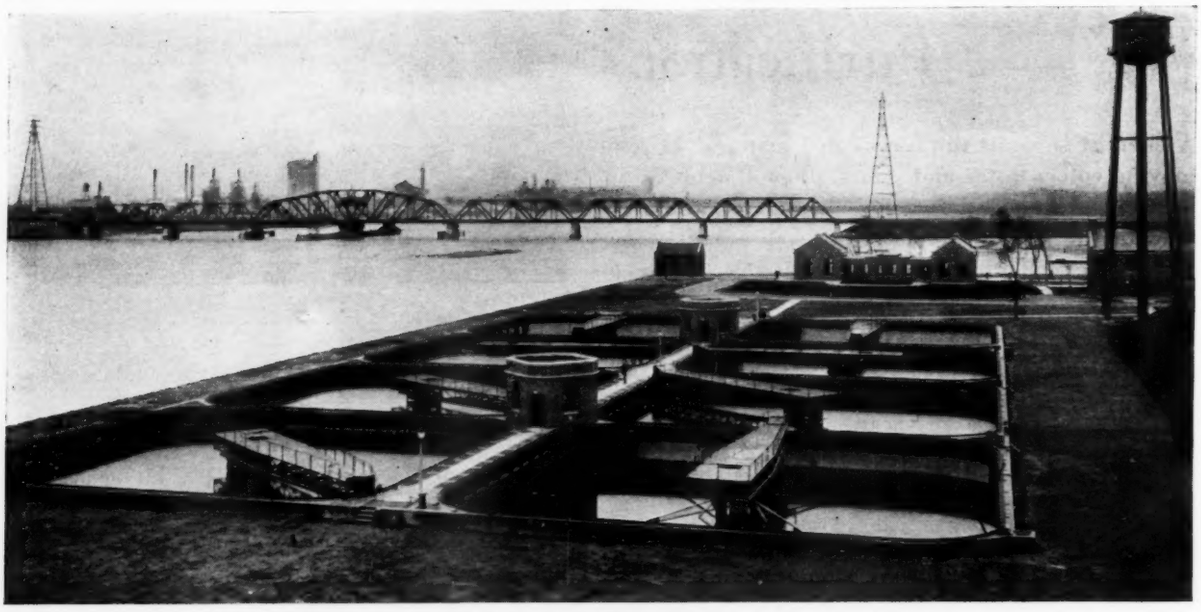
To test for removal of phenol, a dispersion of 50 parts of phenol in a billion parts of water was prepared and a gallon of this shaken with two grains of bleaching clay for one hour, when it was found that about half the phenol had been absorbed by the clay.

To test for removal of excess chlorine, chlorine water was added to a gallon of tap water allowed to stand for an hour, when three grains of bleaching clay was added to part of the water and shaken for half an hour, the other part being kept untreated as a control. The control showed 0.4 part per million of free chlorine and the water treated with clay 0.15 part, which latter was not decreased by further shaking for an hour. Clay used to reduce taste and odor might absorb chlorine applied in prechlorination, but as a large percentage of the bacteria present are caught by the clay, they will be brought into contact with a high concentration of chlorine on the clay surfaces.

The absorption of sulphuric acid by bleaching clay suggests its use for saving the amount of lime necessary to correct the pH of water treated with aluminum sulphate.

Mr. Slocum stated that 10 or 15 pounds of bleaching clay per million gallons of raw water will effectively reduce color.

Mechanical Equipment in Sewage Treatment Works



Toledo treatment plant showing eight 90-ft. Dorr traction clarifiers

IV—Sedimentation Tanks

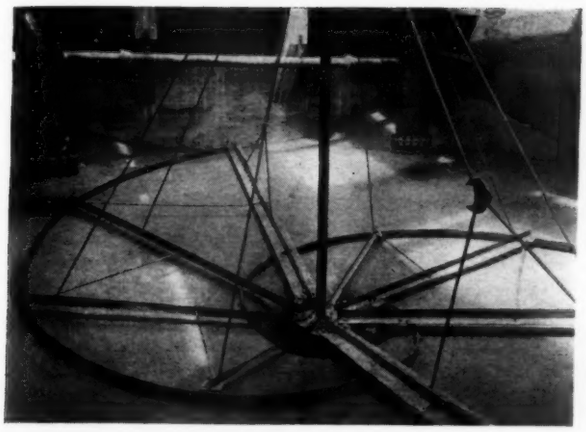
By A. Prescott Folwell
Editor Public Works

THE purpose of sedimentation tanks is to separate the suspended solids of sewage from the liquid by means of gravity. Oils, grease, corks and other matters lighter than water rise to the surface; those heavier than water settle to the bottom, the rate of descent depending on their size and specific gravity and on the amount and velocity of ascending currents of water. These last are of great importance and can not be entirely eliminated in practice, but should be kept at a minimum. Given a certain average rate of descent of the suspended solids (allowing for ascending currents), the sewage should be in the tank a long enough time to permit them to reach the bottom before the bottom sewage begins to rise to the overflow weir. Theoretically, this time (in hours) will be the capacity of the tank divided by the volume of sewage per hour. Practically, the time will be less than this because the flow is never uniform throughout the vertical cross-section of the tank for some distance from each end of it, nor does the sewage often flow at a perfectly uniform rate in the rest of the tank, and because the capacity of the tank for passing sewage decreases as sediment collects on the bottom and in semi-suspension near the bottom.

If the sediment is allowed to remain in the tank, it becomes septic and gases are given off which, rising, produce upward currents that interfere with further sedimentation; while the sludge reduces the tank capacity, frequently by 40% to 90%.

In plain sedimentation it is desirable, therefore, to reduce to a minimum the amount of sludge that collects and to remove it before gas formation begins. This requires complete removal of sludge at least once every day or two. Floating matters, also, should be removed frequently. The old method was to shut off flow of sewage to a tank, draw off the supernatant liquid, then remove the sludge, and refill the tank. Or in some cases a sludge pump was used, the suction being moved slowly over the bottom until as much sludge as possible was removed. The former involved one tank being out of service a large part of the time, and a great deal of very unpleasant labor. The latter method never thoroughly removed all the putrefying sludge, and was generally unsatisfactory, and both were expensive in labor costs.

A great improvement was effected by the introduction of equipment for thoroughly removing sludge continuously or as often as desired, and with little or no appreciable stirring up of sediment or creation of upward currents. This increases the capacity of a tank by the volume of the sludge that would otherwise accumulate, makes possible prevention of any putrefaction in the tank, allows all the tanks to be in service continuously, and eliminates the labor required for sludge removal. It is also claimed that continuous very slow motion of sludge over the bottom of the tank aids in producing a thicker sludge, which is generally desirable. These sludge removers, in most cases, push the sludge to a well or hopper, from which it is removed by hydrostatic pressure of the sewage

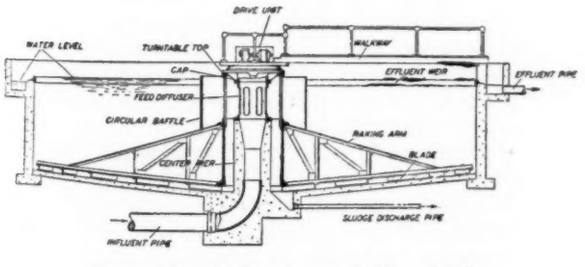


Spiral collector. "Row scraper" at Morristown, N. J. Note sloping bottom in the square corners.

in the tank, or by pumps. One type sucks the sludge directly from the bottom.

There are three general types of sludge collectors: 1—In which the mechanism revolves about a central shaft; 2—In which a series of blades or flights are drawn in a straight line through the tank by endless chains; 3—In which a traveller which spans the tank moves from one end of it to the other, a submerged scraper which is suspended from it pushing the sludge toward hoppers. For using the first, the tank must be round, square or other regular geometrical figure. The 2nd and 3rd can be used in either square or rectangular tanks—generally in the latter.

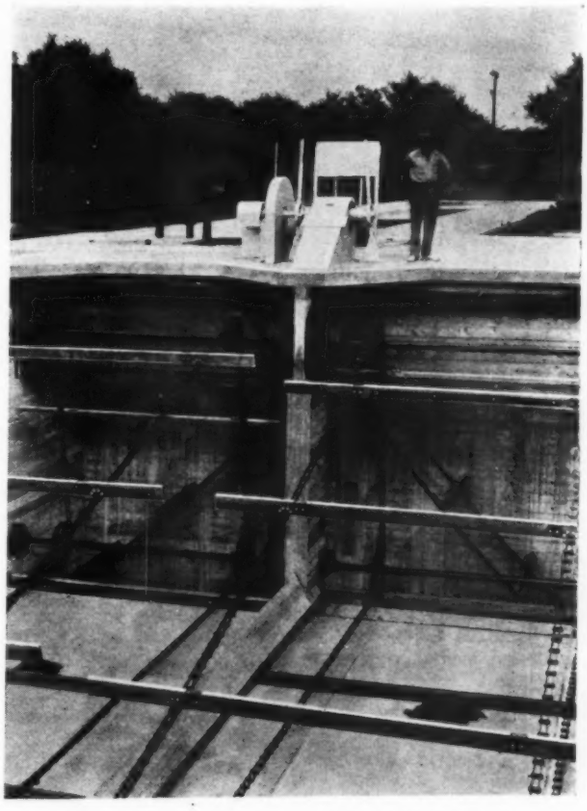
The revolving mechanism has in one pattern a number of arms which carry "plows," "blades" or "squeegees" set at an angle so as to push the sludge continuously but slowly toward a central well as the arms revolve. This revolution is so slow as to be barely discernible, thus avoiding the creation of eddies in the liquid or the re-suspension of the sludge. The power is generally an electric motor, which, together with the revolving equipment, is either supported at the center on a central pier or by a truss which spans the tank; or, in the so-called tractor type, the motor operates, and is supported by, a small tractor which travels on a track surrounding the tank and draws the collecting mechanism with it. In case of the latter, square tanks can be used, a supplementary arm and its scraper-blades sliding radially out to the corners and back toward the center so as to follow the perimeter continuously as it revolves. Another method of using a square tank is to slope the bottom steeply at the corners so that the sludge will slide down within reach of the raking arms. The above are made by the Dorr Co.



Dorr siphon feed and central drive clarifier

In another pattern of revolving mechanism the arms carry, instead of short blades, two spiral sludge scrapers which extend from the outside circular wall to the central well. The several makes of spiral scrapers are all, we believe, driven by motors supported by trusses spanning the tank. These are made by the Hardinge Co., Simplex Ejector & Aerator Corp., Row Engineers, and (in Canada) by F. Hankin & Co.

The 2nd type consists of two endless chains, each moving close to one of the side walls of the tank, carrying, at intervals of several feet, scrapers or flights which extend entirely across the tank and are drawn by the chains along the bottom, the entire length of the tank, then around vertical sheaves at the end, back to the other end and around other sheaves to the starting point. In many cases the return trip of the flights is made at the surface of the sewage and they thus carry scum and floating matters to the other



"Straightline" collectors in Springfield, Ill., tank

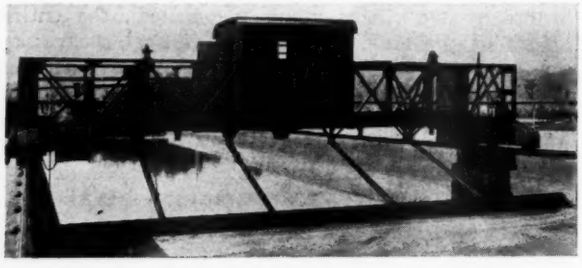
end, where they are drawn off by hand into a trough. The chains are moved very slowly by the sheaves, which are actuated by a motor installed on or near the end wall of the tank. These collectors usually are not operated continuously but about once a day, and draw the sludge into a hopper at the inlet end of the tank, from which it is removed at once. Sludge collections of this type are made by the Link Belt Co. ("Straightline Collectors") and the Chain Belt Co.

The 3rd type originated in Germany and has recently been introduced in this country. It carries one scraper, which draws the sludge along the bottom to the influent end, then rises and returns at the surface, moving the floating materials to the other end of the

tank. All the driving machinery is carried on the traveller. The entire equipment can be transferred from one tank to another and thus one unit can serve a battery of several tanks. The Link Belt Co. has the United States rights for the German "Mieder Collector." A similar collector is made by the Hardinge Co.

The "Tow-Bro Clarifier" removes the sludge through flat nozzles (suggestive of vacuum cleaners), of which there may be 10 to 30 or more, connected to pipe headers that radiate from a central vertical

Nozzles at end of arm, "Tow-Bro" collector

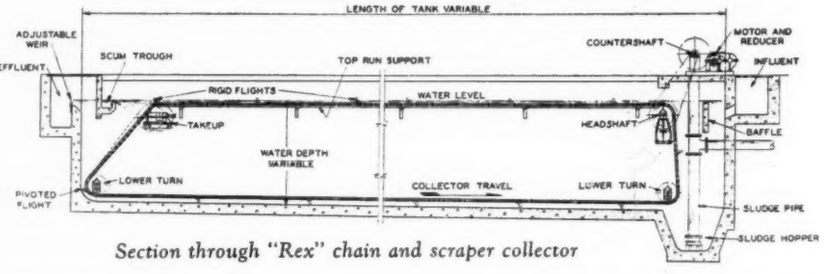


Link Belt Mieder type sludge collector

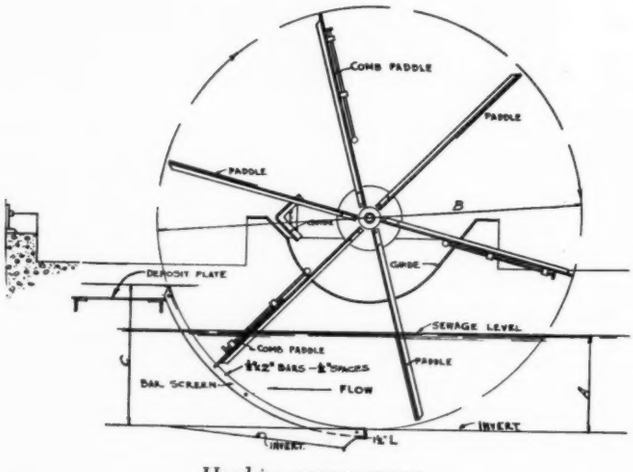
shaft and are parallel to the bottom, the nozzles just clearing the bottom, and being so spaced that the areas beween the nozzles on one arm are cleaned by those on another. There are generally either two or four arms, which connect to a sludge outlet. The sludge is forced into the nozzles and through the arms by the hydrostatic pressure in the tank. These are designed especially for secondary settling tanks of activated sludge plants.

In the tanks using any of these collecting mechanisms the common practice is to admit the sewage at one side of the tank (the end, in the case of rectangular tanks) and withdraw it at the opposite side or end. In some plants the entrance and exit ends are interchanged at intervals. What is believed to be an improvement for circular tanks has been brought out this year under the name of "Sifeed," in which the sewage enters the tank through a centrally located inverted siphon, and leaves it by way of a peripheral weir extending around the entire inside of the tank. The entrance siphon ends in a diffuser which contains a number of long, vertical ports, in front of which a large cylindrical baffle extends several feet below the surface.

Scum removal by manual labor is common, since the amount is generally relatively small. The collectors of the 2nd and 3rd types described above are readily adapted to collecting scum as well as sludge; and revolving mechanisms can carry arms at the surface of the sewage for that purpose. Where there is no sludge mechanism, horizontal spraying with water under pressure has been employed for this purpose. Submerged settling chambers (OMS tanks) have been used in Germany but are not believed to be satisfactory. Imhoff has employed compressed air for aerating the sewage, whereby oil and grease are separated from the sewage and can be skimmed off.



Section through "Rex" chain and scraper collector



Hankin coarse screen

When A=18", B=78" and C=26", when A=30", B=102" and C=34". Width 36" to 48". Capacity 4.5 to 10.0 m.g.d. (British)

Coarse Screens—Additional Data

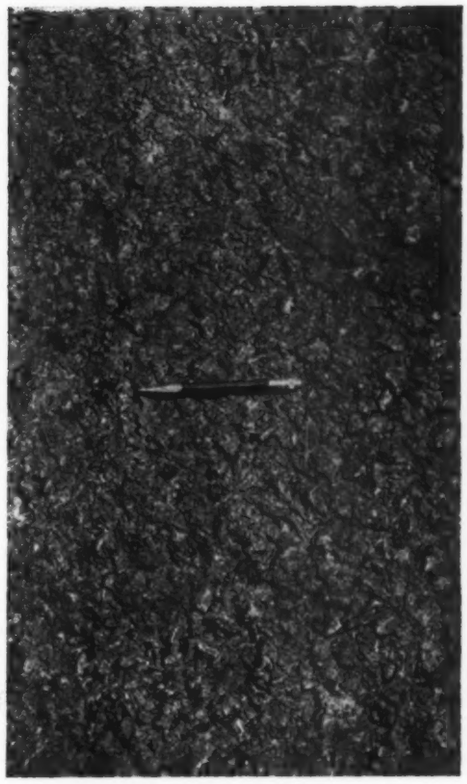
A self-cleaning coarse screen used in some Canadian cities is manufactured by Francis Hankin & Co. It differs from the others chiefly in that the cleaning mechanism is operated by the flowing sewage rather than by a motor. The bars of the screen are arcs of a circle of about 80°, set ½" or ¾" apart. A paddle wheel with six paddles (or twelve, in case of very low flow) is set with its axis at the center of the circle of the bars, and so that the flowing sewage will revolve the wheel, approximately in proportion to the rate of flow of the sewage. Three of the paddles are provided with teeth, which enter all the inter-bar openings and raise the arrested material until it is above the top of the screen, when it is pushed off the paddle, by a metal squeezer operating on eccentric tracks, on to a receiving plate.

Road-Mix Types Low-Cost Roads

Second of the Series on Modern Low-Cost Roads

ONE of the most successful types of low-cost roads has been that known by a number of names, but best described as Road-Mix, Mixed-in-Place or Retread*. This type of surfacing is especially adapted to light and medium traffic; that is, 300 to 1,500 vehicles daily. There are two general types of construction, one the retread or macadam aggregate type employing crushed stone, slag or gravel, from 1½" down to ¾", and the other the graded aggregate, using road material ranging from 1" down to dust. In general, the choice between these types will depend upon (a) the character of the road to be treated and (b) the materials available for the work. The methods of construction of these two types are described in this article by George E. Martin and Bernard E. Gray, both of whom are outstanding in the field of low-cost roads.

*Reg. U. S. Pat. Off. by The Barrett Co.



The non-skid surface of the retread type.

Building the Macadam-Aggregate or Retread Type

By George E. Martin

Consulting Engineer, General Tarvia Department, The Barrett Co.

THIS construction consists essentially of covering the old road with a layer of aggregate, which is coated with bitumen, mixed in place with a road machine, and rolled. A final bituminous seal coat completes the operation. Tops of this type have been built to depths of 3 inches or more, but generally best results are secured with a depth of 2½ inches of loose aggregate, producing a compacted top of about 2 inches. This type can be constructed successfully over any properly drained foundation strong enough to support the loads coming upon it. In practice it has been built over everything from concrete and brick to cinders, but probably its greatest field of usefulness is in the strengthening and leveling of unsatisfactory macadam and gravel roads.

Preparing the Foundation

Minor irregularities in the foundation or old wearing surface will be removed by the new top, but major ones should be repaired before it is constructed. This may be done by cold patching material, by a penetration macadam patch, or by aggregate and bitumen mixed in place on the highway. It is usually safer and better practice to fill up the low spots than to disturb the existing crust by scarifying. Some of these old road crusts, even though quite thin, are still capable of carrying the traffic load if not disturbed.

If the surface of the foundation is not tightly bound, a prime coat will be needed. This is almost always necessary on waterbound macadam, gravel and sand-clay but is rarely required on concrete, brick, bituminous macadam, surface-treated macadam or surface-treated gravel. From ¼ to ½ gallon of tar, with a specific viscosity at 40°C. of 8 to 13, per square yard will be needed. It is the function of this prime coat to penetrate into the surface and bind the particles of aggregate together. No covering material should be used if the road can be closed to traffic for twenty-four hours to permit the prime coat to soak into the surface. If traffic must use the road, only sufficient coarse sand should be used to prevent picking up by vehicles.

The Aggregate

Crushed stone, crushed gravel and crushed slag have all been used in this type. Considerable successful work has been done with uncrushed gravel but it is better to have at least 60% of broken angular pieces. Any suitable road aggregate may be used. It should be uniform in quality and in grading. All the material should pass a 1½" and be retained on a ¾" circular screen, with the usual tolerance of fifteen percent below the lower limit and five percent above the upper limit. Covering material should range in size from ⅛" to ½" with the same tolerance.

Bituminous Material

A total of 1.2 gallons per square yard will be required, as follows: one-half gallon for the first mixing, four-tenths gallon for the second mixing, and one-third gallon for the seal. For slag aggregate the quantities for the first and second mixing should be increased by twenty-five percent.

After the stone is spread, apply half a gallon per yard of bituminous material

The tar for the various steps shall meet the following requirements:

It shall be a refined tar which may be fluxed to the desired viscosity with a water gas tar or distillate of coal tar, and shall also meet the following specifications:

	Tar Prime	*Tar Binder*
Application temperature, °F	60-125	100-150
Specific gravity 25°/25°C	1.11-1.18	1.13-1.20
Water, % by volume, not more than	2	2
Specific viscosity, Engler		
50 Cc. at 40°C	8-13	—
50 Cc. at 50°C	—	15-20 (a)
50 Cc. at 50°C	—	26-34 (b)
Distillation, 100 grams:		
% by weight to 170°C., not more than	7	5
% by weight to 235°C., not more than	20	18
% by weight to 270°C., not more than	30	25
% by weight to 300°C., not more than	35	32
Distillation residue:		
Softening point °C. (R&B) not more than	60	60
Total distillate to 300°C.:		
Specific gravity 38°/38°C., not less than	0.98	0.98
Total bitumen (soluble in carbon disulphide) %	88-97	88-97

(a) For use in spring and fall.
(b) For use in summer months.

Construction Steps

The step by step construction is as follows:

1. Prepare foundation.
2. Apply prime coat if needed.
3. Spread aggregate.
4. Apply first mixing coat of ½ gallon of bituminous material per square yard.
5. Mix.
6. Apply second mixing coat of 0.4 gallon of bituminous material per square yard.
7. Mix and spread.
8. Roll.
9. Fill surface voids with covering material.
10. Sweep and roll.
11. Apply seal coat of ⅓ gallon of bituminous material per square yard.
12. Cover with small-size aggregate.
13. Drag and roll to finished surface.

The first two steps have already been discussed and the remainder will be taken up in detail.

Spreading Aggregate.—Aggregate is spread to the loose depth of 2½" from the back end of a truck or through one of the open-box types of spreader, which gives a much more uniform spread. When the aggregate is spread from trucks it must be leveled out with a blade grader. Hand spreading is rarely needed and better results can be obtained by the use of machinery.

Bituminous Material for First Mixing.—No special precautions are needed in this application. One-half gallon per square yard is the proper amount except when slag aggregate is used. The tar specified for spring and fall mixing will set up rather slowly, thus providing time for the necessary mixing. A heavier tar is specified for summer use.

First Mixing.—The first mixing should be started as soon as the bitumen has been applied. Various machines have been used for this work, such as maintainers or multiple blade graders pulled by tractors; motor graders; blade graders pulled by tractors or trucks; disc harrows; drags; and spike-tooth harrows. Other machines are being developed. At present the graders and maintainers seem to produce the best results. Ordinary spike-tooth harrows segregate the aggregate. A modification of this machine recently placed on the market has a tight deck which the makers claim eliminates segregation.

It will be necessary to turn or stir the aggregate about six or eight times to mix the top properly. Even then the stone may not be entirely coated but it should be approximately so. At the end of the mixing, the material is leveled out ready for the second application of bitumen.

Bituminous Application for Second Mixing.—The second application should be made before the first application of bitumen has entirely dried on the aggregate. Usually it will be made the second day. When the job is well organized and progressing rapidly an even heavier tar may be used for the second mixing and for the seal coat so as to provide a quicker setting material. A tar having a float test at 32°C. of 60 to 150 seconds is used. Four-tenths gallon per square yard is used in any case except for slag.

Second Mixing.—The second mixing is carried on in the same manner as the first one until the aggre-

Then mix and after another application of bitumen, mix again

gate is thoroughly coated. This will usually require from four to six turnings. The mixture is then spread out, leveled, and permitted to cure before rolling. The length of time required will depend on climatic conditions and on the grade of bitumen used.

Rolling.—Three-wheeled rollers weighing not less than 350 pounds per linear inch width of roll are recommended, although smaller ones have been successfully used. Rolling may begin as soon as the mixture becomes tacky or sticky. When a very heavy tar is used the rolling may begin as soon as the mixing is finished. If the mixture sticks to the roller wheels they should be kept wet. A heavy tar requires fast mixing while the regular material specified allows more time to get the mixing finished and the road in shape. Planing with a grader, maintainer, or drag after rolling once over will aid materially in obtaining an easy riding road.

Filling Surface Voids.—The surface voids should be filled with just sufficient covering aggregate to fill the voids and no more. Too little filling will permit the seal coat to go down into the road and defeat its object. Too much may separate the seal coat from the road surface and cause it to peel off in spots.

The filler should be swept into the voids during the rolling so as to insure uniform distribution. A broom attached to the roller is the best implement to produce this result.

Seal Coat

It is good practice to open the road to traffic at this time, for it is better to delay the application of the seal coat for several weeks, thus permitting the top to cure thoroughly under traffic. If this is not possible, the application of the seal coat should be delayed until all of the mixing operations on the entire job have been completed. The whole length of the road can then be sealed at one time. The seal coat must be covered with aggregate and rolled. Dragging this cover during the rolling will eliminate minor irregularities in the surface.

Quantities and Cost

For a loose depth of aggregate of two and one-half inches the following approximate quantities of material will be required per square yard:

	Stone or Gravel	*Slag*
Mixing aggregate, pounds	170	140
Covering aggregate, pounds	40	30
Bitumen (prime coat) gallon	0.4	0.4
Bitumen (first mix) gallon	0.5	0.6
Bitumen (second mix) gallon	0.4	0.5
Bitumen (seal coat) gallon	0.33	0.33

Costs naturally will vary depending upon the delivered costs of the various items entering into the road. Mixing, rolling and incidental labor should not cost more than five to eight cents per square yard. The average cost for the finished job will run about fifty cents per square yard.

The road should receive a maintenance seal coat the year after construction. After that time it is maintained like a bituminous macadam. A seal coat every three to five years depending upon climatic conditions and upon traffic will keep it in good shape.

Construction Details of the Graded Aggregate Type

By Bernard E. Gray
Highway Engineer, The Asphalt Institute

THE graded aggregate type is particularly adapted to surfacing existing gravel and traffic-bound roads because of the presence of a considerable amount of fines below the ¼-inch size, and because, by making small additions of aggregate to the prepared surface, an ideal grading can be obtained without extra expense while utilizing all of the material already in place. In the operation of crushed stone quarries, the material under ¼-inch size has been largely a waste product, and has accumulated in a large tonnage at many plants. With the graded aggregate type, therefore, there is an outlet for this material in combination with the sizes above ¼-inch, which works out to the benefit of the producer and the user alike.

Grading and Preparation of Aggregate

If the existing road surface is sufficiently thick and stable, all of the aggregate for the road-mix top may be obtained by scarifying. New material may be added, if necessary, for the full depth of the road-mix course, or any combination of new material and light scarifying may be provided. Whenever new material is added, it is desirable to place it on the roadway several weeks before the application and mixing with the asphaltic material, so that the surface may be carefully conditioned and bladed to obtain a uniform and even distribution of the new aggregate. After such preparation, the surface is scarified and loosened to a depth of approximately 2½ inches, and thoroughly pulverized with a disk-harrow. In general, the grading of the aggregate prior to the application of the asphaltic material need not conform to narrow limitations, but on any single project the grading should be made as uniform as practicable throughout its entire length. Satisfactory general grading limitations are as follows:

Passing 1-inch screen	100 per cent
Passing ¼-inch screen	50 to 70 per cent
Passing 10-mesh sieve	35 to 60 per cent
Passing 200-mesh sieve	7 to 14 per cent

Where the road surface contains an excess of fines,

And after rolling, sweep and roll filler into the surface voids

a simple sieve analysis quickly shows that the new material should be of a size above ¼-inch, whereas if the old road contains an excess of coarse particles then the new material should be largely under the ¼-inch size.

Asphaltic Materials

Either of two asphaltic products can be used in the construction of the graded aggregate type—a non-hardening liquid product or a cutback asphalt containing slowly volatile distillates. Both products should have approximately the same original viscosity, to enable them to be mixed properly with the mineral aggregate by harrowing and blading. The non-hardening material is recommended only for arid or semi-arid areas, such as are found in certain western sections, and the hardening, or cutback asphalt should be used in most of the other areas. Specifications for these two classes of products, as recommended by The Asphalt Institute, are as follows:

Asphaltic Material No.	3	4
Class	*Non-Hardening*	*Hardening*
Viscosity (Furol) at 122°F.	200 to 320	200 to 320
Distillation, per cent by volume.		
Total distillate to 437°F., not more than	2	5
Total distillate to 600°F., not more than	15	..
Total distillate to 680°F., not more than	25	..
Distillate between 600°F. and 680°F., not more than	..	12
Tests on residue from distillation.		
Penetration 77°F., 50 g. 1 sec., not less than	350	..
Penetration 77°F., 100 g. 5 sec.		100 to 350
Ductility 77°F., not less than		60
Per cent soluble in carbon disulphide, not less than	99	99

One advantage of the graded aggregate type is that the correct amount of asphaltic material required for a particular mineral aggregate can be predetermined very readily with a degree of exactness which insures uniform results. As a result of field and laboratory studies, certain formulae have been worked out, so that, having determined the percent of voids in any aggregate, the amount of asphaltic material required is quickly determined. These results are given in the table in the next column.

The deduction factor of six is simply an amount which has been determined from laboratory experiment to be the per cent of voids required in a finished mixture which will allow expansion and contraction, due to temperature changes, without any harm to the mixture itself. The other terms are self explanatory.

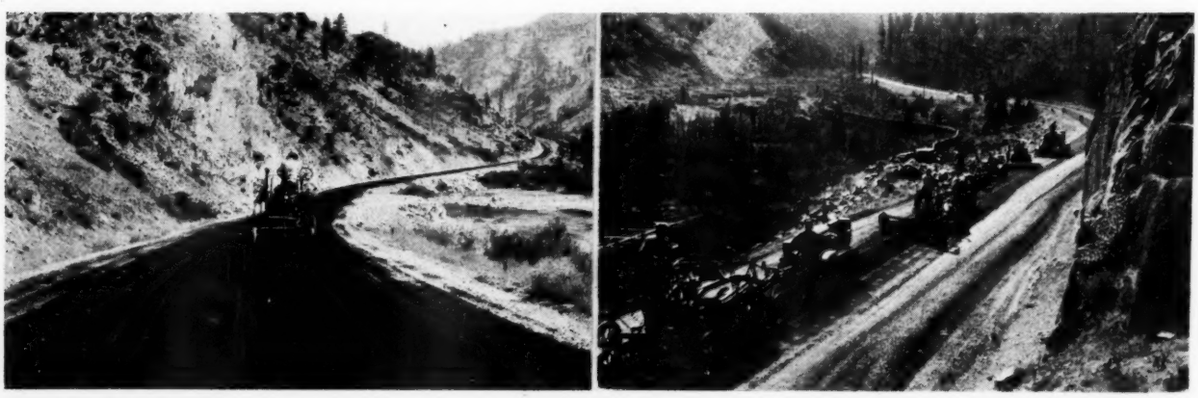
Gallons Asphaltic Material Required

% of Voids in Compacted Min. Agg.	*Deduction Factor*	*% of Voids to be Filled*	*Gallons of Asphaltic Material Per Sq. Yd. 1 Inch Thick*	*Per 100 Ft., 20 Ft. Wide, 1 Inch Thick*
15	6	9	.50	112.2
16	6	10	.56	124.7
17	6	11	.62	137.1
18	6	12	.67	149.5
19	6	13	.73	162.0
20	6	14	.78	174.5
21	6	15	.84	187.0
22	6	16	.90	199.5
23	6	17	.95	212.0
24	6	18	1.01	224.4
25	6	19	1.07	236.9
26	6	20	1.12	249.3
27	6	21	1.18	261.8
28	6	22	1.23	274.2
29	6	23	1.29	286.6
30	6	24	1.35	299.0
31	6	25	1.40	311.5
32	6	26	1.46	324.0
33	6	27	1.52	336.5

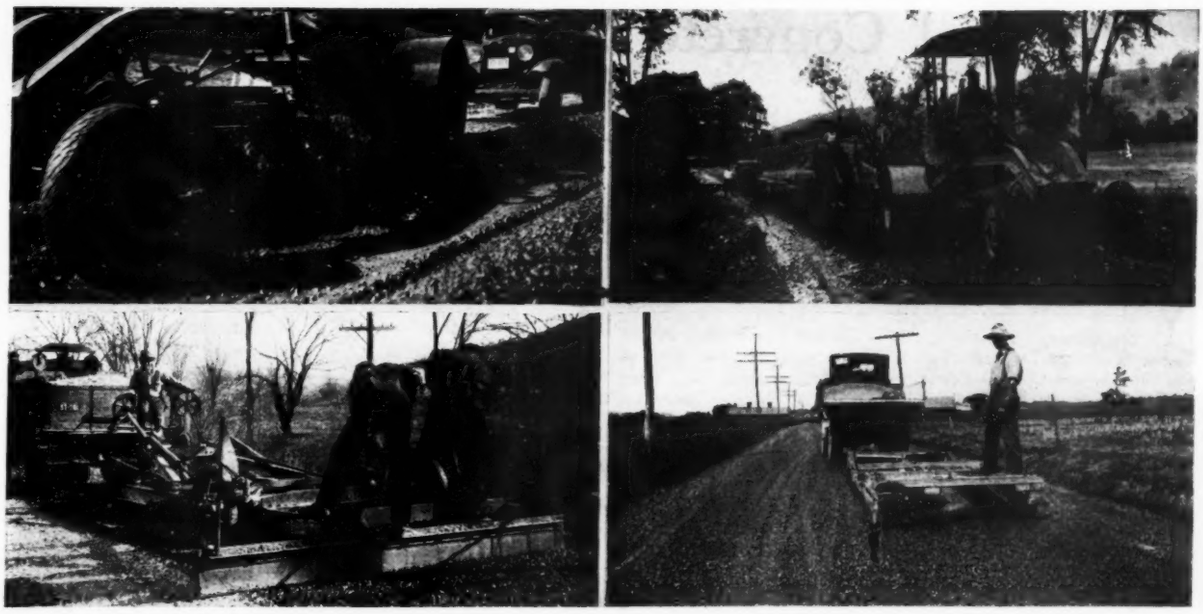
Construction Procedure

Having the aggregate spread evenly over the road surface in loosened condition, the asphaltic material is applied uniformly at a temperature between 160° F. and 200° F. by means of a pressure distributor. Application of the asphaltic material is made at the rate of ½ gallon per square yard in each application until the total required quantity has been applied. For example, for a two-inch compacted thickness the total quantity will range usually from 1¼ to 1¾ gallons per square yard, and will accordingly involve three or four applications. A disk-harrow or other mixing type of equipment immediately follows the distributor, so as to incorporate the asphaltic material at once with the aggregate. This is a great advantage, in that traffic may continue to use the road with practically no danger of picking up the bituminous material, as the immediate mixing with the fine particles of the graded aggregate has the effect of producing a rather dry mixture which does not splash. The disk-harrow then continues to work up and down the treated strip until a uniform mixture has been obtained, after which the second application may be immediately made, and the same procedure of mixing again followed until the total amount of asphaltic material has been incorporated with the aggregate.

After this initial mixing has been completed, the material is bladed with a road grader and moved from one side of the road to the other, which brings about



Left, by blading thin layers from center or side windrows, smooth riding surfaces are secured. Right, a complete operation under way. A distributor is in front followed by two disc harrows, then two blade graders. Photos by U. S. Bur. Pub. Rds.



Steps in the construction of the road-mix type surface, and a completed Vermont road

a certain amount of curing or drying action. The operation is repeated until the mixture presents a uniform appearance in color and is free from any fat spots, balls and uncoated particles, after which it is brought to a windrow down the center of the road, with traffic moving on either side.

The weakest point in any road-mix surface is the edge, and in the graded aggregate type ravelling may be completely prevented by providing a thickened edge prior to finishing of the surface. Prior to spreading the mixture over the surface, a small triangular cut is made with the grader at each side about two inches deep at the outer edge and feathering to zero at a point about three feet in toward the center. The material removed from this cut is thrown out on the shoulder and provides lateral support for the completed mixture as it is spread.

Using a grader, the mixture in the windrow is then spread in several thin layers over the entire width of the roadway by cutting at the toe of the slope of the windrow at each side, and with each pass of the grader moving sufficient material to make a layer of about ½ inch depth. It is very desirable that this method of spreading be followed, as it is by this process of building-up thin layers under traffic that the superlative smooth-riding qualities of this type are obtained. The first pass of the grader will fill the V-shaped cut at the outside edge, and with the subsequent layers builds up a thickened edge which resists any ravelling and maintains the integrity of the entire surface. After the windrow has been entirely spread over the surface, blading operations are continued for a period of a week or ten days as the material is gradually consolidated under traffic. No rolling is required, except occasionally at the outside edges for the purpose of hastening initial compression, and best results are obtained by a combination of traffic consolidation and repeated blading.

Several stock piles of the mixed material should be set aside to be used as patching material for correction of any small depressions which may develop during the compaction operations. After the mixture has been thoroughly consolidated and smoothed, a light seal coat at the rate of ⅛ gallon per square yard is applied, using the same asphaltic product as employed in the original construction. This is covered with a light dressing of sand or ½-inch maximum size stone chips at the rate of 10 pounds per square yard. The broom-drag then should be operated over the surface to insure even distribution during the final period of compaction under traffic.

This type of construction is particularly applicable to areas where gravels are plentifully available and is a means whereby thousands of miles of existing gravel roads can be transformed into excellent smooth-riding surfaces by merely scarifying the existing roadbed and adding a little new material and an appropriate amount of asphaltic material; or where commercial quarries are available, so that aggregates formerly waste products are cheaply available for admixture to existing surfaces, plus the asphaltic materials. Where all of the aggregate is obtained from the existing roadbed, the cost is simply that of scarifying and blading plus the asphaltic material. The cost using existing roadbeds entirely is about $700 per mile per inch of depth for 18-foot width. With new aggregate, the total cost would be about double.

Many of the western states have adopted this type of construction for their primary road system under light to medium traffic, (viz.: 300 to 1500 vehicles daily) and many thousand miles of such types of surfaces have been constructed as Federal Aid projects. Maintenance costs are invariably lower than for untreated surfaces, and where the type has been employed on a large scale it is estimated that the construction costs are more than completely absorbed over a ten-year period as contrasted with maintaining an untreated surface.

While this type as yet has been used but little in the east, it should grow rapidly in popularity because of the flexibility of the operations and the extraordinary smooth-riding qualities obtained.

Practical Concrete Construction Details

By William E. Barker
Highway Engineer, Portland Cement Association

III—Proportioning Aggregates (Continued)

By Void Cement Ratio and by Absolute Volume

VOID-CEMENT ratio and absolute volume are actually being used in proportioning concrete mixes, the first by the Illinois Division of Highways and the second by the Texas Highway Department. Proportioning on the basis of the void-cement ratio was developed by Professors A. N. Talbot and Frank E. Richart, at the University of Illinois, based on test data which indicate that the strength of concrete may be determined from the ratio of voids in the mortar to volume of cement. (By voids is meant the space in the mortar that is filled by water and air.)

The strength for a given ratio of voids to cement is constant only at basic water content. (Basic water content is that quantity of water per unit volume of mortar which produces minimum voids in the mortar.)

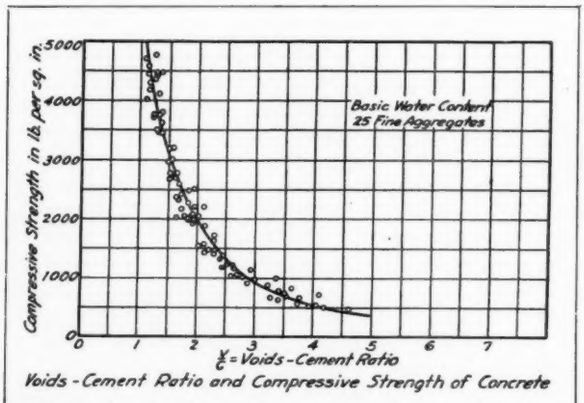
If a small amount of water is added to a mixture of sand and cement, the volume of the mixture increases. Apparently the water forms a film on each particle of material, held there by surface tension, which film holds the particles apart and so increases the total volume. As more water is added, a point of maximum volume is reached at which each particle is provided with a film of moisture. Further additions of water inundate the particles, reducing surface tension and decreasing the volume. At a certain water content the voids are barely filled with water and the volume is a minimum. If still more water is added, the volume is again increased.

Basic water content is determined experimentally by adding small increments of water to a mixture of dry sand and cement until minimum volume is secured.

More than this quantity of water is required to secure a plastic and workable concrete, and this additional water will reduce the strength of the concrete, so the strengths determined from the void-cement ratio relation are corrcted for water in excess of basic water content.

In designing mixes by void-cement ratio, curves are first made up showing the voids in the mortar for various quantities of water and various ratios of cement to sand. From these, other curves are developed showing voids, water content and void-cement ratio in the mortar for these various mixes, using the water content which will give a concrete of the desired workability.

The amount of coarse aggregate which can be used with a given mortar is then determined by trial; concrete mixtures are made up and tested for strength and a curve showing strengths for various void-cement ratios is plotted, to be used for future design.



Curve showing basic water content of twenty-five fine aggregates

In practice, in a large organization like a highway department, the various curves are made up in advance by the central laboratory. The mix is then designed by determining the quantity of cement required, with the given sand, to give the void-cement ratio for the desired strength, and by adding the proper amount of coarse aggregate to this mortar to give the desired concrete.

The amount of coarse aggregate which should be added to the mortar is determined in the field by trial, but the inspector is guided by a ratio $\frac{b}{b_o}$ previously determined by the laboratory, in which b is the absolute or solid volume of coarse aggregate per unit volume of concrete, and b_o is the absolute volume of coarse aggregate per unit volume of coarse aggregate. If $\frac{b}{b_o}$ were to equal 1, it would mean that the particles of coarse aggregate in the concrete were in contact, with no mortar holding them apart anywhere. Even if this were possible, the concrete would be too harsh and unworkable to be used in any construction work. The farther the value of $\frac{b}{b_o}$ departs from 1, the farther apart the stone particles are in the concrete, and the more mortar (and therefore the more cement) is required. The proper value depends upon the use to which the concrete is to be put, the equipment used to handle and finish it, and the characteristics of the materials. For paving work in Illinois, it is between 0.65 and 0.77 for both gravel and crushed stone.

The void-cement ratio is similar to the water-cement ratio, since it recognizes that strengths vary with varying water content. There is a further similarity in that its use requires that mixes be determined by trial. But more of the work of design is done by the central laboratory and less is left to the judgment of the man in the field.

In proportioning by absolute volume, the Texas Highway Department first fixes the amount of cement to be used per cubic yard of concrete and the cubic feet of water per sack of cement. Subtracting the absolute volume of this water and cement from 27 gives the absolute volume, in cubic feet, of aggregrate in a cubic yard of concrete. (This result is slightly in error because air voids in the concrete average about 1¼ per cent. If greater accuracy is desired, air voids of 1¼ per cent may be assumed.)

Knowing the absolute volume of aggregate which is to be used, the man in the field then has to determine what part of this volume shall be fine aggregate and what part coarse aggregate. This is determined by actual trial batches, guided by a limiting quantity of coarse aggregate established by the department laboratory for all aggregates in the state.

The quantity of coarse aggregate is expressed by the ratio $\frac{b}{b_o}$ (This is the same ratio used in void-cement ratio proportioning and the same discussion applies to it.) The limits set for this ratio by the Texas Highway Department are 0.78 to 0.87, when the concrete is to be used for pavement, which means that a larger proportion of coarse aggregate is used in Texas than in Illinois.

In practice, the Texas engineer who is designing a mix in the field assumes a value midway between the limits—say 0.83—and makes up a batch of concrete with the materials that will be used on the job, using the specified cement factor and water-cement ratio. If the concrete proves too harsh he reduces the ratio to perhaps 0.80; if it seems oversanded, he increases it perhaps to 0.85, and mixes up another batch. When exactly the desired concrete is secured, the proportions are calculated in pounds and given to the contractor.

Both highway departments report greater economy and much more uniform strengths since these methods of design superseded fixed proportions.

Water Works System of Walton, Kentucky

Pump house and settling basin, Walton water works.

Gate house and dam, looking across partly filled reservoir.

By C. N. Harrub, B. S.

Member A. S. C. E.; Engineering Association of Nashville; A. W. W. A.; NE. W. W. A.

THE city of Walton, Kentucky, has until this year had no public water supply. Late in 1930 the Board of Trustees decided to ascertain the attitude of the people with respect to the installation of a water works system by holding an election for a $25,000 bond issue for that purpose. The election carried with a very large majority, and the Board of Trustees then proceeded to authorize the issuance of $35,000 in water revenue bonds to complete the financing of the project.

In 1931 the city limits were extended to include a number living outside the original limits who wished to have the water service when the system was installed. This brought the total population to approximately 1,000.

The writer's firm was engaged for designing and supervising construction of the system, and preliminary surveys were begun in November, 1930. Construction work was started early in March, 1931, and the plant put into service in August.

The water is derived from an impounding reservoir made by constructing an earth dam across a small stream about half a mile from the main street of the town. The watershed has an area of about 160 acres, largely grass land, with a small portion wooded.

A careful study of several watersheds was made before a selection was made, in order to assure a sufficient yield and adequate storage to carry the town through a long dry spell. Although runoff records were not available for the particular section, study of records of similar terrain in the state indicated that an ample supply for a good many years could be obtained from this watershed, and the dam was designed to give a supply of 75,000 gallons per day for 120 consecutive days without rain, with a drawdown of fourteen feet, with a liberal allowance for evaporation and seepage. The dam is 30 feet high above the bed of the stream and approximately 500 feet long at the crest. The entire upstream face of the dam is rip-rapped with stone 12 inches deep. A concrete spillway 10 feet long and 4 feet below the crest of the dam is provided at the easterly end of the dam. A concrete flume, designed to carry the entire runoff at maximum rainfall recorded for this section, extends beyond the downstream toe of the dam, to prevent any erosion near the dam. A reinforced concrete gate house is located near the upstream toe at the center of the dam. In this gate house are the drain valve and two supply valves, which permit drawing water from two levels. The drain will permit dewatering the entire reservoir, in case of need. The water surface of full reservoir is appoximately eight acres.

Near the downstream toe of the dam is the settling basin and pumping station. Water flows by gravity to the settling basin, where the elevation is controlled by a float valve. As the water enters the basin, sulphate of alumina is added, an Omega dry feed machine being used for this purpose. The water then passes through a baffled mixing chamber and into the settling basin proper, which is a rectangular return basin. The extreme end of the basin is separated off as a suction well for the pumps, and the water enters this through a skimming weir extending the entire width of the well, just below the water surface. Liquid chlorine is applied to the water as it enters the pump suction mains.

No filters are included in the present system, but the plant is so arranged that they can be readily added later when needed.

At the southerly end of the town is a 100,000 gallon tank on a 100 foot tower, which gives adequate pressure for fire fighting in practically all parts of town, without the use of a pumping engine.

The distribution system is of centrifugal cast pipe, using copper service connections throughout, and every connection is metered. Meters were considered essential, to prevent unnecessary waste of water, and as added assurance of maintaining an adequate supply over long dry periods.

Work on the dam was started early in March and carried on as rapidly as weather conditions permitted, as it was desirable to impound as much as possible of the spring rains, if the reservoir was to be filled before winter. Rains fell on several occasions before the dam was completed, but no water was impounded until the dam was completed, and the rip-rap sufficiently well advanced to prevent the water from rising above it. As soon as it was considered safe, the drain valve was closed and the reservoir allowed to fill, and as the dam was completed some time before the distribution system, the reservoir was filled, and water was flowing over the spillway before the system was put into service.

The total cost of the waterworks system, including purchase of real estate, engineering, legal services and advertising, was approximately $56,045, the principal items of which were as follows:

Reservoir and dam, including gate house and spillway	$13,221.80
Distribution system, including:	
17,580 feet of 2", 4" & 6" pipe	17,390.00
49 feet of 2", 4" & 6" valves and boxes	1,155.40
24 4" x 6" hydrants	1,785.00
10,296 lbs. of cast-iron specials	654.85
107 service connections and meters and boxes	3,976.50
Miscellaneous items	1,289.20
Pumping station and equipment:	
Excavation	95.00
Concrete settling basin	2,207.00
Pump house	649.25
Equipment, pumps, chlorinator, alum feed machine, master meter, etc.	2,915.00
Elevated tank and foundations	7,200.00
Sanitation of water shed	964.00
Real estate	2,542.00
	$56,045.00

From the above figures the average per capita costs of the various items is as follows:

Reservoir, dam, gate house and spillway	$13.22 per capita
Distribution system complete	26.25 per capita
Pumping station complete	5.87 per capita
Elevated tank complete	7.20 per capita
Sanitation of watershed	0.96 per capita
Real estate	2.54 per capita

Design and supervision were by the C. N. Harrub Engineering Company, with V. S. Brogden as resident engineer in charge, and W. L. Hailey & Company of Nashville, Tenn., were general contractors.

Automatic Pumping Stations Report Their Own Status

So completely automatic are the new Pikesville and Townson pumping stations for the Baltimore (Maryland) bureau of water supply, that it is merely necessary for headquarters to call the unattended stations on the telephone if reports of operating conditions are desired. A unique method of obtaining these automatic reports was designed for the purpose by General Electric engineers, and was recently put into operation.

The pumping equipment—two motor-driven pumps—is automatically started and stopped in accordance with the water level in the reservoir. A hand-operated switch in the pumping station makes it possible to predetermine which pumping unit shall start in response to the water level indication but, should this "preferred" unit shut down because of trouble or some other reason, the second unit is automatically started in its place.

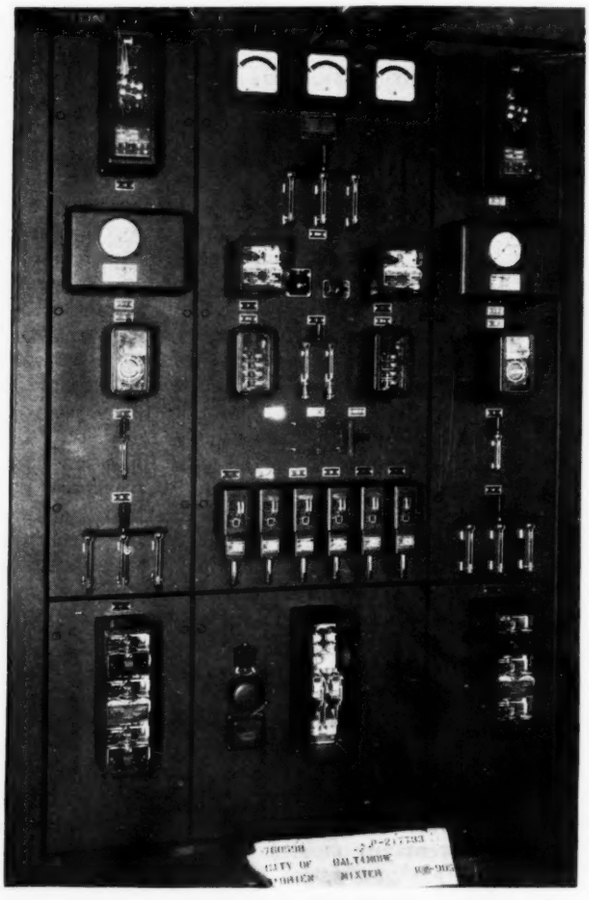
By means of the special audible indicating equipment, operators can obtain reports of the conditions in the pumping station from any point which has telephone connection with the station. The pumping station number is dialed in the usual manner, and the indicating equipment is immediately set in action. The desired information is transmitted by means of a series of codes made up of long and short buzzes heard in the telephone receiver. The different codes are separated by a single-stroke bell signal also heard in the telephone receiver.

The first report transmitted by the code tells whether or not conditions generally are satisfactory and correct at the station. In that event, the equipmen continues its report, telling which of the two pumping units is selected as the preferred one; whether water is flowing into or out of the reservoir; what the water pressure is in five-pound steps from 50 to 70 pounds; what the water level is in the reservoir in one-foot steps over a six-foot range. If the first report, however, showed that the station was not in satisfactory operating condition, then an additional set of codes is transmitted, indicating whether or not voltage is available for each of the pumping units, and whether or not either unit is locked out of service because of the functioning of some protective device.

When the audible equipment is once started, it proceeds to report on all the various conditions described and then repeats the code signals as a check. If, however, someone is visiting the pumping station and wishes to answer the telephone he may do so without interference from the audible indicating equipment because it is disconnected from the telephone as soon as the receiver is lifted. If the visitor wishes to call out of the station, he may do so in the usual way.

Meters Reduce Waste in Paris, Ill.

C. W. Lemon, city manager of Paris, Illinois, states that the whole town was metered last year, reducing pumpage from around 1.5 to 2.0 million gallons per day to 300,000 to 500,000 gallons. The population of Paris is 8,800, and there are 1,502 active services. The average monthly consumption for the past fiscal year was 9,083,000 gallons, and the maximum monthly consumption, which occurred in June, 1932, was 14,730,000 gallons.



G. E. Automatic switch gear for Baltimore automatic pumping station.

Non-Biological Sewage and Sludge Treatment*

Willem Rudolfs
Chief, Dept. Sewage Research, New Jersey Agricultural Experiment Station

IN spite of the rapid accumulation of information on biological treatment methods made during the last few years and the utilization of the findings, which will ultimately make the processes intense, continuous, short and without nuisances, interest in non-biological sewage treatment processes is increasing. Probably the main reasons for this trend are the greater mechanization of equipment and the fact that the biological processes are becoming more and more complicated, requiring increased skill and scientific control. We know more about the processes, but biological treatment has been and is at present usually practiced in a very crude way. This may seem to be so because we have a better understanding, although many problems are unsolved and require investigation; or it may be because of the complexity, wherefor proper control is too intricate and too expensive. Those who are mechanically inclined will turn naturally to methods like filtering, incineration, centrifuging, etc., which at the outset look more simple.

It is assumed that non-biological methods are inherently less complicated than biological methods. This, however, is not necessarily correct. It is also sometimes assumed that non-biological methods of treatment may be less costly than biological methods. This assumption may be correct in some instances, but is questionable as a general statement because of the fact that a certain amount of energy must be expended for the destruction of the waste material. When natural forces are employed to destroy or stabilize putrefactive material, the energy is supplied by the source itself, but conditions must be made favorable for the forces to act. When the destruction or stabilization must be accomplished solely by energy applied, the ultimate cost may be considerably greater. Nevertheless, inquiries into non-biological methods will undoubtedly bring forward ways and means of treatment which are preferable over biological methods, no matter how great the latter's perfection will be.

With our present knowledge, biological treatment will be preferable in certain instances, in a number of others they should not be used. Even at present a number of cases could be cited, particularly where large quantities of certain industrial wastes are mixed with domestic sewage, where the employment of biological methods is illogical and fundamentally wrong.

The trend of searching for non-biological means of treatment will undoubtedly increase during the next few years. It is possible that the pendulum will swing far out and anything biological considered of less interest.

Those of us who are engaged in studies for the purpose of finding the best and most economical methods of sewage treatment will not overlook any method which looks promising. We have been conducting laboratory and semi-plant experiments for about a year at the Plainfield, N. J., sewage treatment plant, with a grant from the International Sanitation Engineers, Inc., on a purely physical-chemical method of sewage treatment. A historical development and some results obtained are presented in the May, 1932, issue of of the Sewage Works Journal, but there are several points of practical interest to the sanitary engineer which might be emphasized.

Method

Briefly, the method as developed consists of displaceable tanks filled with slag through which the coarse screened sewage is filtered upward, and incinerating the adhering sludge in a specially constructed calciner. After filtration, the partially clarified sewage is treated with chemicals, the sludge settled and filtered through the same slag filter receiving the sewage. Rapid sand filters may be added to obtain a highly purified effluent. The filters produced continuously about 70% suspended solids reduction and a 55 to 60% reduction in biological oxygen demand, with a raw sewage application at a rate of about 75 mil. gal. per acre per day.

The slag retained the heavy solids, which filled up the spaces between the pieces, and these solids acted apparently as a mat holding the finer particles of suspended solids. Perhaps one of the most interesting findings was that 2½ feet of slag was about as efficient in removing the amount of suspended solids which could be removed within a given time, as was a layer of slag of 7 feet or more. This would indicate that a comparatively thin blanket of sludge performed the main straining function. The blanketing effect was probably also responsible for the fact that there was no floating material or oily scum in the effluent tank, although during laundry days a greasy scum would form quickly on the surface of the raw sewage when left standing.

The layer of slag was covered with about two feet of effluent. The slag was removed when fouled and this, together with the layer of effluent over the filter, were most likely responsible for the absence of odor from the filters. Only when the filters were left standing idle in hot weather for several days bacterial decomposition would set in and hydrogen sulfide odors start to develop.

Incineration

Several incinerators have been built lately to destroy the coarse and fine screenings at sewage treatment plants, and no doubt a number will be built in the future to take care of the sludge, when methods have been worked out satisfactorily to dewater the sludge. For the incineration of the sludge adhering

*Journal Series paper, N. J. Agricultural Experiment Station, Dept. Sewage Research. Written exclusively for PUBLIC WORKS.

to the slag, an experimental incinerator was built by the Isbell-Porter Co. of Newark, N. J., which required charges of from 250 to 300 pounds of sludge coated slag. During the drying operation the incinerator produced considerable odor, which was found to be corelated to the high temperatures maintained and the moisture content of the sludge(1). Experiments were conducted to absorb the odors in oil, activated carbon, etc., which showed that most of the burnt vegetable odor could be eliminated, but not all of it. By utilizing the hot gases for preheating, the odors are expected to be eliminated similar to those in modern garbage incineration plants.

The honeycomb slag of 1½" commercial size which was used stood the heat of incineration (1200°F) very well. About 2% could be screened out through a ½-inch screen after each drying and burning period. The drying and burning required 45 minutes for batches. In a full-size plant it is proposed to feed the incinerator by a continuous process.

Cost estimates made by the Isbell-Porter Co. for a plant with an average daily flow of 1 m.g.d. and a maximum hourly flow of 1.5 m.g.d. for filtering and sludge destruction was $110,000, and operation cost $13.50 exclusive of labor. The larger the plant the lower initial and operation costs per m.g.d.

The type of treatment investigated would appear to produce results somewhere between primary and secondary treatment devices and as such might have a place where more than settling and less than oxidation is required.

Any method of physical or physical-chemical treatment has undoubtedly certain advantages over biological treatment, the most important perhaps being the fact that mechanical treatment is positive in operation as long as the equipment is kept in running order. Simplicity of control may be a factor worth while considering. A method whereby the sewage is treated rapidly and the sludge disposed of at the same time without digestion or drying perhaps comes closer to the goal. Probably the most important disadvantages of any physical method whereby movable or moving equipment is used, are the possibilities of a breakdown and the fact that putrescible material in solution is not stabilized. Experiences in sewage treatment where tanks with movable parts are used have shown that breakdowns are very infrequent. Where high treatment of the effluent is required to stabilize material in solution, chemical precipitation or oxidation methods must be used in addition.

(1) Water Works & Sewerage, July, 1932.

Iron Pipe Intercepting Sewer Nearly Mile Long

By R. B. Parks

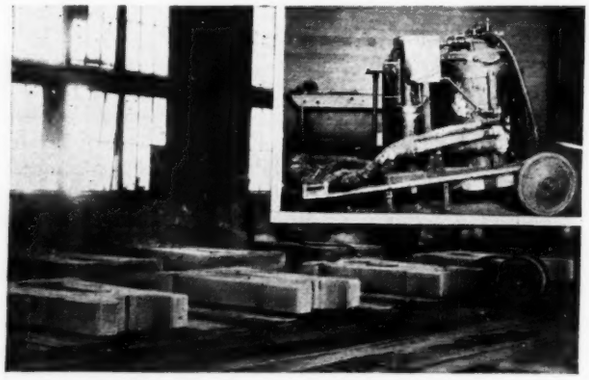
LOS ANGELES, CALIF., last year began constructing the San Pedro sewer, which has several interesting features. It consists of 4,961 feet of lead-jointed 20-inch cast-iron pipe laid along the ocean front, most of it near the foot of a bluff and supported on piers two to eight feet above the beach level to keep it on the hydraulic gradient. Part of the right-of-way, however, is across the Fort MacArthur rifle range, and here it is under ground, reaching a depth of 9 feet cover. There is also 327 feet of 12-inch vitrified clay pipe.

The iron pipe is in 16-foot lengths, furnished by the American Cast Iron Pipe Co., and calculated to have sufficient strength to support itself, filled with sewage, when supported at the ends only. Each joint is supported by a concrete pier. At angles in the line there are special anchor piers. Also there are 17 expansion piers, where Simplex expansion couplings are used.

Connections with tributary sewers are made by means of special castings, ordinary 20 in. by 8 in. T's set in the tops of piers. Of these there are five. Six 20 in. by 20 in. T's, with the branch set vertical and covered, are provided to serve as clean-outs. The trestle piers are of different heights; eight are 4 ft. high; 139 are 6 feet; 35 are 8 feet, and 61 are 10 ft. Where the pipe is under ground, a lighter pier is used reaching down to rock, an average distance of 9 feet below the sewer invert.

The expansion pier used is really two trestle piers, one on each side of the expansion joint, 2 ft. 10 in. apart between centers. Each trestle pier is a concrete frame consisting of sill, two battered legs and a cap in which the pipe rests; the sill, 12 in. thick, having a flat V-shaped bottom permitting it to rock slightly when the pipe expands or contracts and being set in a recess 8 in. deep in the concrete base, the ½ in. between each side of the recess and the sill being filled with asphalt. The legs are of reinforced class F concrete, 12 in. thick, 3 ft. apart at the top with a 1:9 batter. Each anchor pier is a solid block of concrete 3 ft. square at the top and battered 1:12 at the sides and 1:5½ at the ends.

In portions of the right of way through the Fort MacArthur rifle range the excavation reached a depth of 18 feet for the piers, and the pipe trench varied from 5 to 11 feet deep, and 26,320 ft. b. m. of lumber was used for sheeting. Ground water was handled through a manifold with Dayton unions at frequent



Six-foot trestle piers in factory shed, ready to be waxed by machine shown in insert.

intervals, while every 16 feet a 2-in. pipe connected the manifold to a pump, allowing connections and extensions to be made to the manifold without stopping pumping.

A unique feature of this job was the use of a process of waxing the surfaces of the concrete piers to protect the concrete against any disintegration due to saline deposits or sewage acids; which process had been used before only on a silo. The piers were cast in a shed, kept moist for seven days, and not removed to the job until fourteen days old. Before removal they were given the paraffin treatment by what is known as the Stoesling process.

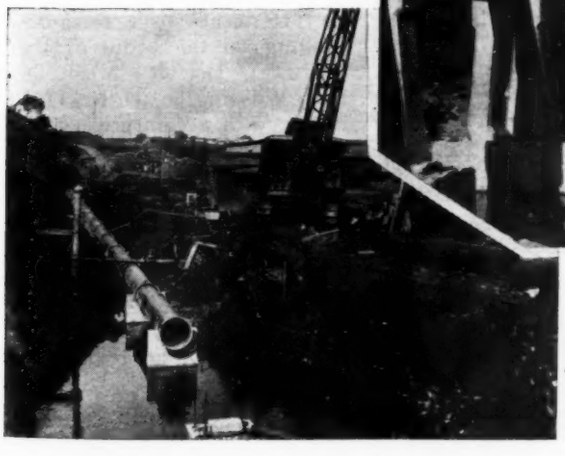
The machine used consists of a large cylinder containing water heated to 200° F., in which rests a paraffin container. Pressure exerted at the top of this container forces the melted paraffin through a pipe line into a hose. Two smaller cylinders contain oil heated to 320° F. in which are coils through which air is forced, the heated air passing into two lines of hose, one attached to each side of the paraffin hose, thus keeping the paraffin hot. At the ends of the hose lines a fine spray of paraffin between two jets of hot air are applied to the concrete, and capillary attraction helps the heated concrete to absorb the paraffin, which is forced upon it under considerable pressure.

Tests made on the job by the contractor and representatives of the city engineering department showed that, given concretes of uniform density, the depth of penetration of the paraffin depends upon the amount of pre-heating given the surface. Also, other conditions being the same, the stronger and denser the concrete the less the pentration.

The process is the invention of Ludwig Stoesling, formerly colonel of engineers in the German army, and is being promoted by two Canadian war veterans, W. G. Porter and W. W. Dutton.

This work was designed under direction of H. G. Smith, engineer of sanitary sewers, approved by W. T. Knowlton, sanitary engineer, and by city engineer J. J. Jessup. The contract was let to the Lee R. Weber Co., contractor, for $49,696. Work started August 20, 1931, and completed in April of this year.

Anchor pier (at angle in line) with clean-out



Above—Pipe on 4-foot. trestle piers.
Center—Expansion joint on M pier.
Left—Pipe on piers with 3 to 9 feet cover crossing Fort MacArthur.

Monthly Rates of Water Consumption

Water consumption in Charlottesville, Va., during the fiscal year September 1 to August 31, 1930-1931, totalled 654,852,100 gallons. The average monthly consumption was 54,571,000 gallons, and based on this, the percentage of the monthly consumption for each of the months was:

September	140.7	January	65.1	May	95.0
October	125.0	February	83.8	June	98.0
November	100.0	March	88.6	July	120.3
December	73.4	April	91.8	August	119.5

The city has a population of 20,000, the average consumption per person per day being 90 gallons. C. H. Swing is superintendent of Public Utilities.

Brick for Gutters and Parking Strips

Advantages of this type of street construction and approved methods of laying it. Widths used in a number of cities.

ATTENTION was called, in a recent report of the American Road Builders' Association, to the increased use of brick for gutters, or combined gutter and parking strips, especially with bituminous streets. Among the advantages cited for this type of construction are that it permits the thorough compaction of the bituminous material next to the gutter, maintains a true and even flow line, and gives a surface which will not deform under the weight of heavy vehicles, either parked or in motion. It also furnishes a surface that is resistant to the chemical action of gutter fluids; and in northern cities, where gutters fill with ice during winter months, a material not subject to injury through any ordinary snow or ice removal methods.

When paving brick is used for gutter construction, the base course of the pavement should be laid continuously from curb to curb, without a break and without any longitudinal joint at the edge of the gutter. This construction, which is shown in the accompanying illustration, gives added strengh and results in a firm and integral bond between the brick gutter or parking strip and the pavement surfacing.

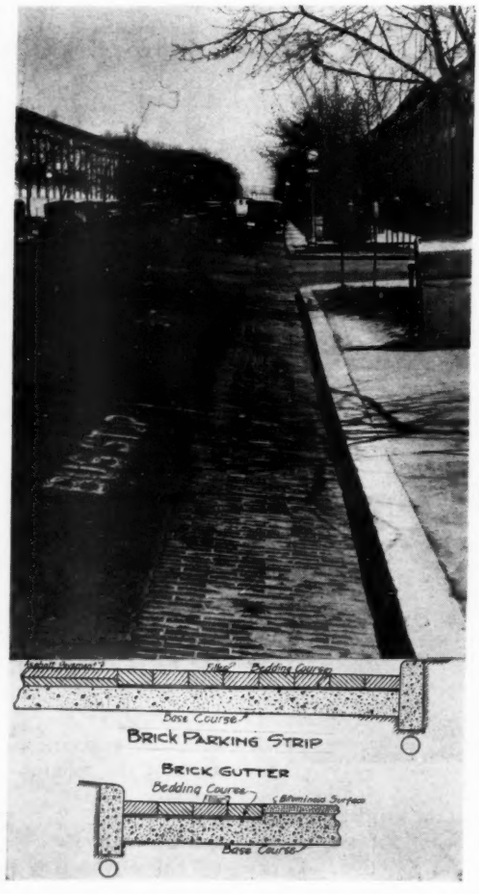
Gutters of this type may be made from 2 to 7 feet in width. The most desirable width will depend somewhat upon local practices in regard to parking, and to local conditions of wear. The trend appears to be toward the wider types of gutters, as these possess a number of advantages. The 7-foot strip is needed if it is desired that all four wheels of a car parked parallel to the curb shall be on the parking strip, whereas if it is desired only to afford better pavement construction and to catch oil drippings from cars parked diagonally, one-half this will be sufficient.

The brick may be laid at right angles to the curb, or parallel. Any of the usual types of brick may be used. Various depths of brick are obtainable, from 2½ to 4-inch. It is very desirable that the depth of the brick and sand cushion should be the same as the total depth of the pavement surface, so that the base can be laid continuously and uniformly from curb to curb. The bedding course should be not less than half an inch in depth; this amount added to the depth of the brick should equal the thickness of the pavement surface. In those cases where the pavement thickness is less than the thickness of the brick and of the bedding course, it will be necessary to depress that section of the base under the gutter and parking strip so that the finished surface of the gutter and of the pavement proper will be at the same elevation. It is much more desirable, however, to so design the pavement that no depression or change in the base is required.

Cement grout filler has been most generally specified, particularly in the east, where brick gutters and parking strips have been in use for many years. When grout is used, it is squeegeed into the joints. There is, however, no reason why asphalt filler can not be used, and it is especially desirable when the wider strips are used.

Because of the narrowness of the gutter and its proximity to the curb, it is not always possible to use the regular three-ton roller for rolling the brick. In such cases, hand tamping, done carefully and thoroughly, may be relied upon to provide an even surface. Where the wider gutters or strips are used, it is usually practicable to use a roller.

In receiving bids on brick gutters and parking strips, built in conjunction with other types of pavements, it is generally customary to have the bid on the pavement proper include the cost of construction of the parking strip and gutter as well, and to include the specifications for them in the general specifications.



A parking strip in Washington, D. C.

The widths of gutters reported by their city engineers as being used in several cities are as follows: Columbus, O., usually 24 inches; Pittsburgh, Pa., 15 inches to 4 feet, depending on the width of the roadway; Detroit, Mich., 4 feet; Washington, D. C., 13½ inches, with a transverse slope of 1¼ inches; Atlantic City, 31 inches; Charlotte, N. C., 18 inches to 2 feet. Probably 12½ to 25 inches is the range for gutters proper, the wider strips being provided for parking.

If bricks are laid parallel to the curb, a width of three bricks will give approximately 12½ inches, and 6 bricks about 25 inches. If the more general custom of laying the bricks at right angles to the curb, breaking joints with a half-brick, is followed, two bricks will give an approximate width of 18 inches, four bricks 36 inches, and 8 bricks 72 inches.

THE EDITOR'S PAGE

Will RFC Funds Be Available for Public Works Construction?

The Advisory Engineering Board of the Reconstruction Finance Corporation is issuing, in connection with the Corporation's Legal Department, Instruction Circular No. 3. This circular gives rulings relating to the interpretation of the law, and also regulations and requirements covering the submission for review of propositions for which loans are asked. It is understood from preliminary conversations with the Board that projects must be developed thoroughly by the engineer, with a report covering such features as the need, the local unemployment situation, principal engineering features, etc. Data must be supplied to indicate that the project cannot be financed in any other way; for instance, that bonds cannot be sold to the public or to bond handling firms. The self-liquidating character of the project must be established, and a project is not considered self-liquidating which depends upon taxation.

The project or department involved must be a separate entity financially, with separate accounting, and with funds distinct from all other city funds. In other words it must be a business organization separate from other municipal services. Thus, if a sewage treatment project is under contemplation, the Sewer Department must be organized (or reorganized, if necessary) with proper legal authority, so that it is a distinct and separate legal entity, having separate revenues, as from sewer rentals rather than from taxation; and the set-up must indicate revenues sufficient to cover operating expenses, depreciation, interest, and amortization by means of a distinct fund for the purpose.

The RFC will probably determine the rate of interest on a project and will either buy bonds or accept the bonds as collateral on notes, the bonds to be sold in the public market when market conditions improve so this is possible. The Board of Engineers appear to favor projects which can be put into the construction stage quickly, and also prefer a large number of small projects, which would thus affect a number of communities.

However, judging from recent press reports, the RFC intends to apply the above requirements very strictly. If this is so, very few communities will get any assistance, even though it was undoubtedly the intention of Congress that the money appropriated for relief be used, at least to a reasonable extent, for public works construction. That being the case, since public works construction offers the best means of meeting the present emergency, there is only one thing to do. That is to start something.

We urge that every city official get in touch at once with the congressman and senators representing his territory, and demand that representations be made to Washington so that a saner view of the situation be adopted, allowing needed credit to cities, towns and villages now ready to go ahead with permanent, needed, and self-liquidating public works. Chambers of Commerce and other civic organizations can help. Now is the time to start.

Reduce Water Wastage

Even though metering of water has become quite general, there are still many municipalities which supply water at "flat" rates. At most of these places, the consumption is large, which necessitates a correspondingly large investment in pumps, wells, filter plants, and other supply works.

Metering lowers the consumption of water, not by decreasing legitimate consumption, but by reducing waste. This results in lower operating cost, increased pressures for fire protection and better service to consumers. It permits existing mains, pumps and purification plants to serve for a longer period, allowing surplus funds to be used for extensions of service to new consumers, for replacing antiquated machinery and equipment, and for the thousand and one other needs that invariably crop up.

Another cause of waste is leakage from the distributing system. Some such leakage is anticipated, but when the loss of water reaches abnormal amounts, a survey should be made to determine the sources of loss and methods of prevention. A village in upstate New York, through the intelligent work of its water superintendent, has during the past year located and stopped leaks totalling 220,000 gallons a day—about one-third of its total consumption. As a result it has saved on pumpage costs enough to carry out some extensions and improvements long needed.

Getting Ahead in Engineering

The Health Department of Jefferson County, Birmingham, Alabama, gives weekly talks on health and health factors from the local radio station. These talks are prepared by an engineer of that department, and cover a variety of community and personal health problems. Not only are they of value in showing other engineers how to prepare readable and interesting material, but they convey facts in a most pleasing and painless fashion.

But our purpose is not to urge our readers to write for copies of these talks, even those on such topics as "Drinking Water," "The Fly," "Malaria" and others equally interesting (though it would be well worth while to do so), but to point out that the engineer of to-day must be more than a strictly technical man. The engineers who have suffered most during the past few years of shift and change have been those who held most strictly to the technical side of engineering—draftsman, designer, construction man, etc. The men engaged in the administrative and management side of engineering have generally been more fortunate, or perhaps less unfortunate.

In the first six to ten years of his work, the engineer can get his necessary basic technical and construction experience, and after that time he ought to have pretty well in mind his plans for the future, and should aim at a position which will allow him to use his broader talents, reinforced by his engineering training and experience. If he does that, he's much more liable to be "sitting pretty" when another "reconstruction period" comes along.

Water Standards for Meeting Requirements of Industries

By A. S. Behrman
Chemical Director, International Filter Co.

THE water supplied to the community as a whole must meet one set of requirements—in several ways, a rather rigid and uniform set. The water supplied to industry, on the other hand, must in many cases meet additional and very different standards—differing not only in general from the standards of the community supply, but differing also in the various industries.

It follows that the water supply of a community cannot be expected to meet the highly specialized and individualistic requirements of certain industries. The fact that an improvement is indicated and justified does not always mean that it can be afforded by the community, particularly when the community is small. Under these circumstances it is perfectly proper and permissible for the community to pass on to the individual householder or industrial consumer the task of improving the water for his particular use beyond the safety and clarity provided by the community. Equipment for nearly every purification requirement of that sort is now available.

Probably of most interest to water works men are the requirements of water used for making ice, soft drinks, boiler feed, and laundry and textile industries.

Water for the Ice Industry

Ice at present is generally frozen from raw water rather than from distilled water as formerly. The ideal water for making ice is one that is free from any dissolved or suspended matter.

The troublesome impurities most common in water used for making raw-water ice are the bicarbonates of calcium and magnesium—that is, so-called "temporary hardness." When a water containing much of these impurities is frozen, the compounds are precipitated as a white or dirty deposit of calcium carbonate and magnesium hydroxide, tending to make the ice opaque and brittle, and to exhibit a heavy white core which the housewife knowingly points out as "ammonia" in the ice.

Another most objectionable impurity is iron, as amounts of this impurity, even though present in amounts as small as 0.3 or 0.4 parts per million, may give the ice a reddish-brown cast and core.

Lime treatment removes the bicarbonates of calcium and magnesium bodily, and leaves practically nothing in their place. If the only impurities in a water were "temporary hardness," no matter how great in amount, they could be reduced with proper lime treatment to 40 or 50 parts per million. Iron also is removed by lime treatment as the insoluble hydroxide.

Softening bicarbonate waters by the zeolite process is entirely unsatisfactory for making raw-water ice, for this treatment does not reduce the amount of dissolved solids in the water, but actually increases them; moreover, the calcium and magnesium bicarbonates present in the raw water are replaced with a corresponding amount of sodium bicarbonate, which is one of the most objectionable impurities in water for making raw-water ice, since it tends to make the ice not only opaque, but also quite brittle, resulting in cracking and shattering.

Aside from lime treatment, the most common types of water purification processes we employ in connection with raw-water ice manufacture are color removal and neutralization. A little color is decidedly objectionable for raw-water ice, even though the amount may be perfectly inoffensive for the community water supply. Another extremely useful method of treatment we have developed for certain cases is the neutralization of residual alkalinity remaining in the water after the lime treatment, or of the alkalinity originally present in a raw water.

Obviously, these special methods of treatment cannot be looked for from the community water treatment plant. In fact, if the neutralization of alkalinity was practiced for the community supply, the effect would be disastrous on the community water distribution system, due to the lowered pH and alkalinity of the water and its consequent corrosive nature.

Water for the Laundry and Textile Industries

The principal requirement of the water for these industries is that, in addition to being free from obviously objectionable iron, it shall also be as free as possible from calcium and magnesium—in other words, be of "zero hardness." For obtaining "zero hardness" we are limited to zeolite softening. But even if a community could afford to turn water of "zero hardness" into the mains, it would be impractical and illogical to do so; for this water, entirely free from calcium and magnesium, could not put a protective coating on the metal surfaces, and so would invite red water troubles throughout the community with eventual disintegration of the mains themselves. Over-zealous zeolite enthusiasts have on occasion overlooked this fact to their sorrow. In general, it may be said that there is no economic justification for turning water into the mains with less than 4 or 5 grains per gallon of hardness; and when the zeolite process is used for softening the community supply, it is customary to mix the "zero hardness" effluent from the softeners with enough of the raw hard water to give the mixture a hardness of 4 or 5 grains per gallon.

Here again, in the textile and laundry industries, we have a set of requirements that the community water supply can meet only part way.

Water for the Soft Drink Industry

The water used for carbonated beverages must be clear and free from objectionable taste, otherwise it will interfere with the appearance and flavor of the finished beverage. Iron is also highly objectionable in most cases.

High alkalinity from whatever source is objectionable in that it neutralizes the flavoring acids of the beverage. The pH of many carbonated beverages is as low as about 3; and there is a direct relation between pH and taste.

Any objectionable taste, or anything contributing to an off-taste, is objectionable and must be removed

if possible. Excess chlorine, chlorophenols, algae and similar tastes may completely ruin the bottlers' product.

Some kinds of organic matter cause foaming in the beverage, both when it is being carbonated in the first place and after the bottle is opened.

The diversity of special considerations involved in water treatment for the soft drink industry makes it impossible for the city treatment plant to attempt to cope with all these problems. This is properly the problem of the bottler himself, who can now obtain help from reputable manufacturers of water treating equipment with specialized experience in the bottling field. Of especial interest to this audience is the pressure activated carbon purifier for the removal of chlorine, chlorophenols, and other objectionable tastes and odors.

Water for Boiler Plants

A good water for boiler feed purposes, and particularly for a modern high-pressure boiler, must be extremely soft, for the prevention of scale; and must yield, on evaporation in the boiler, a minimum of soluble and suspended solids, in order to avoid foaming and priming at reasonable concentrations without excessive blowdown losses. While there must be sufficient excess alkalinity of the proper kind to insure the precipitation of scale-forming impurities, the ratio of sodium carbonate to sodium sulphate in the boiler feed water must be kept within certain limits to prevent caustic embrittlement. In the case of boilers operating at 250 pounds or over, this ratio of sulphate to carbonate must be not less than 3 to 1. Finally, in many cases, the water must be substantially free of oxygen, in order to avoid corrosion.

In order to meet these rigorous requirements, the raw water must in most cases be softened, usually by the lime-soda process, less frequently by the zeolite process. A secondary softening treatment, now rather popular, is the addition of sodium phosphate directly to the water in the boiler. If necessary for providing the proper sulphate-carbonate ratio, excess alkalinity of the softened water is neutralized, or sodium sulphate is added. De-aerating heaters are employed to remove oxygen and free carbon dioxide as well.

Occasionally a raw water is so nearly pure initially that the little treatment required may be carried out in the boiler itself; but such cases are becoming more and more exceptional as the standards of boiler water quality become more and more exacting.

Other industrial applications also have their own individual requirements, which I will not go into; but the above considerations are sufficient, I believe, to bring out the difference between rational water treatment for the community supply as distinguished from water treatment for the industries, and to indicate the results which may reasonably be expected from each type of treatment.

The above is condensed from a paper presented by Mr. Behrman before the Pennsylvania Water Works Operators Association.

Chironomus Larvae in Water Supply

The recent appearance of red worms in the water supply of one of the principal Kansas cities presented a problem which is fortunately not encountered by most waterworks men.

This particular water supply is obtained from a river. The raw water is pumped over an aerator, and flows through coagulating and settling basins to the filters. The filtered water is pumped into a large uncovered storage reservoir from which it flows by gravity to the city distribution system. To control algae growths in the clear water reservoir, ammonia chlorine treatment of the filtered water is used and a residual is maintained in the clear water reservoir.

During the summer of 1931, small worms were found in the water supply at various points in the distribution system. The worms were a source of much complaint. However, they disappeared shortly and no preventive measures were taken. During the latter part of May, 1932, the worms again made their appearance in the distribution system. They are for the most part red in color and vary in length from 1/32 to ½ inch. Samples of the worms were collected and identified as members of the "Chironomus" family originating from a midge fly.

In describing a similar larval contamination of a clear water reservoir at Cincinnati in 1931, Bahlman (Journal of the American Water Works Association, May 1932) discusses the life cycle of the Chironomus briefly as follows:

"From textbooks we read that the midges or Chironomidae deposit their eggs on water weeds, floating scum, or on the clean surface of water. A generation is completed within about five weeks. The larvae are bright red worms, commonly called blood worms, and are about ½ to 1 inch in length. They swim about with an active undulating motion. They develop in all types of water, in springs and in stagnant pools, in shallow rills and in the deepest lake bottoms at great pressures. The high oxygen-carrying capacity of the haemoglobin of the blood plasma makes life possible where little oxygen is present. Under favorable conditions these worms develop in enormous numbers, and are the source of an abundant food supply for fish. Developing from the egg in the bottom ooze, the larvae proceed to burrow through the muck, fashioning tubular shelters for themselves out of silt or any material that is available. The wall of the tube is held together by the silk-like secretion of the salivary glands. These shelter-tubes are open at both ends, with a net-like silken barrier at one opening. By vigorous undulations, the larva draws a current of water into the tube and feeds upon plankton organisms which become enmeshed in the silken net. It may also reach out from the tube and feed upon disintegrated plant tissues. These shelter-tubes and burrows will ramify into every available crevice, and often large numbers of the worms thus escape casual observation. The final stage of the metamorphosis, the fly, is similar in size and appearance to the common mosquito, from which it might not be distinguished by the layman."

In the case of the Kansas supply previously referred to, there is little question but that the eggs were laid in the clear water reservoir. Attempts to control the worms by chlorination or treatment with copper sulfate have been unsuccessful with doses which can be safely used. A complete covering of the clear water reservoir is the only means of insuring safety from larvae contamination. It has been demonstrated that the worms are unable to penetrate the filters so that if the filtered water is adequately protected from the egg laying insect, there is no danger of Chironomus larvae entering the supply. (Kansas Municipalities.)

High Early Strength and Truck-Mixed Concrete in County Highway Engineering

REPORTS from county highway engineers all over the United States indicate a considerable progress in the utilization of new ideas and materials, and the employment of modern equipment. Despite a late start, due to the uncertain conditions of the few months past, a great deal of construction work has been reported as now under way.

High Early Strength Cement

Out of one group of 371 counties, data have been selected concerning the use of high early strength cement and of truck-mixed concrete. Of the 371 counties, 67 report the use of high early strength cement. This was used principally on straight paving work and on bridges and culverts, but was reported as used also on intersections and for replacement, repair and patching work. Reports from some of the counties follow:

High early strength cement has been used with satisfaction in pavement construction by Rawlins Co., Kans., and Delaware Co., O., but its use for patching purposes has not been so successful in Mulnomah Co., Ore. In Matagorda Co., Tex., however, it has been found satisfactory. Brooke Co., W. Va., has employed it in constructing intersections, since its use allows much earlier opening of the road to traffic.

The use of Incor high early strength cement on highway construction in Mobile Co., Ala., was not only satisfactory but allowed the road to be opened to traffic 24 hours after the work was completed. John R. Peavy is county engineer. Napa Co., Calif., has used high early strength cement on bridge and culvert construction with good results, and Marin Co., Calif., has had similar good experience in pavement replacement work. San Joaquin Co., Calif., has used it for minor repairs and bridge work, and Lee Co., Fla., in pavement and sidewalk construction. Colquitt Co., Ga., has used it for pavement construction.

Cook Co., Ill., has also used high early strength cement in pavement construction and found it to give a strength in three days equal to that of ordinary portland cement in six to eight days, but it requires some additional finishing help. Shelby Co., Ind., also reports excellent results on pavement construction, as does Warren Co., Ia. O'Brien Co., Ia., has used it for repair of pavement "blow ups." Genesee County, Mich., uses it for repairs and for intersections, and Ottawa Co., for patching. Madison Co., N. Y. finds its use important from the time-saving point of view.

Bridges and Culverts

The use of high early strength cement in the construction of bridge abutments is reported as satisfactory by Bates Co., Mo. Garfield Co., Wash., also has used it for bridge abutments and has found that these can be put into service within seven days. Fulton Co., Mo., has used it to some extent in culvert construction, finding it very satisfactory, and the same results are reported by Napa Co., Calif., which has used it on culverts and bridge decks, and by San Joaquin Co., on bridge work. Pinellas Co., Fla., has also used it in bridge work, and Broward Co., in adding to the height of draw-bridge abutments, in which work it is very valuable because of its quick-setting properties.

Linn Co., Ia., has used it in culvert construction, and Winneshiek Co. in raising bridge grades. Rush Co., Kans., employs it for bridge floors and Sumner Co. has used some for bridge posts and rails. Sullivan County, N. Y., finds it very satisfactory for bridge work, as do Chemung Co., N. Y., and Franklin Co., O. Garfield Co., Okla., has used it for emergency bridge construction.

Kendall Co., Tex., has used it for culvert construction when it was desired to hasten the opening of the road, as has Wharton Co., Tex., while Upshur Co., W. Va., has used it for bridge floors and approaches.

Truck-Mixed Concrete

Multnomah Co., Ore., has used truck-mixed concrete for bridges and pavements on hauls up to 8 miles in length and has found it satisfactory. Brooke County, W. Va., has used it for widening work, with good results, the maximum haul being 5 miles. Mobile Co., Ala., has also used it, but the work required no haul in excess of 4 miles. Fresno Co., Calif., has used truck-mixed concrete on bridge construction with a maximum haul of 16 miles, with excellent results. Marin Co., Calif., uses it for concrete shoulder work, the hauls running up to 5.8 miles. Colquitt Co., Ga., has used it in pavement construction on hauls up to 3 miles.

Warren County, Ia., has used truck-mixed concrete for foundation work, with hauls up to 5 miles. Ottawa Co., Mich., has been using truck-mixed concrete for widening old pavements and finds this method very satisfactory. The maximum haul has been 5 miles. Bergen Co., N. J., has employed it on hauls up to 7 miles, Chautauqua Co., N. Y., on hauls up to 10 miles, and Westchester Co., N. Y., on hauls of 5 to 8 miles for curb and sidewalk construction. Hamilton Co., O., has used it for road and bridge construction on hauls up to 4 miles, and Franklin Co., O., on hauls to 10 miles for bridge foundations. Payne Co., Okla., reports hauls up to 11 miles for culvert and building work.

Credit for Lower Road Costs

Thos. H. MacDonald, Chief, U. S. Bureau of Public Roads, in an address before the American Road Builders' Association, attributed decreasing road costs (prior to any effect of the present depression) to improvement in engineering designs, in contractors' methods and in efficiency and adaptability of equipment. He said: "The decrease in road costs for the five-year period from 1924 to 1929, taken from unit prices of Federal aid projects, was about 27 per cent. During this same period there was a constant increase in the quality of the roads produced generally. The road contractors and equipment manufacturers are to be credited with a large part of this decreased cost, through improved organization and better methods, which permitted higher production with the same organization cost. Better engineering designs, better inspection, and a pride in their output on the part of both contractors and engineers, produced at a constantly decreasing cost, a constantly better quality and more durable roads."

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HIGHWAYS and PAVEMENTS

Unloader and Conveyor Save Money on Road Job

THE utility and economy of portable conveyors for unloading aggregate from cars is demonstrated by their use on a New York state construction job by Hogeboom & Canfield of Utica, N. Y.

The purpose of the conveyors on this particular job was to unload sand from hopper-bottom cars and deliver it to a stock pile alongside of a batching plant. There are also stock piles of two sizes of crushed stone, but this material is unloaded by a clamshell bucket operated by a gasoline crane. The crane formerly unloaded the sand also, but it was found that the capacity of the crane was not great enough to unload all the materials, and also deliver the materials from the stock piles into the batching bins. Therefore it became necessary to have two crane operators, one to operate in the daytime delivering materials into the batcher and unloading what material he had time for, and a night operator to unload enough materials onto the stock piles to keep them going the following day, or to devise some other method. The problem was figured out on an economic basis, and the answer was the two conveyors to unload all the sand, leaving the crane operator with stone only to unload. After the sand is unloaded, however, the crane puts it into the batcher.

The conveyors have unloaded an average of four cars of sand each day, and with one unloaded Sunday, this makes a total of 25 cars in a week. This is about an average week's run during the course of the job, which will last about three or four months.

Two men handle the sand unloading. They spot the cars, drop the hoppers, and start and stop the conveyors. While the conveyors are running, the two men stay inside the car all the time, as the sand is washed and sticks to the car, and the conveyors need no attention while running. The average time for one hopper of a car is about twenty minutes, or a total running time of about forty minutes to unload a car, the average capacity of a car being about 50-55 tons. This is not counting the time required to shift the car after one hopper has been unloaded, but is net unloading time.

The unloaders used on this job were made by the Portable Machinery Co., York, Pa.

Crack Control in Bases for Sheet Asphalt

A research project started by the Rhode Island State Board of Public Roads and under way at the present time is an attempt to control the cracking in the base of a sheet-asphalt pavement. At the present time cracks in a reinforced cement concrete pavement are fairly well controlled by the use of reinforcement and longitudinal and transverse joints. Continuous

Unloader and Conveyor Installation on job of Hogeboom & Canfield

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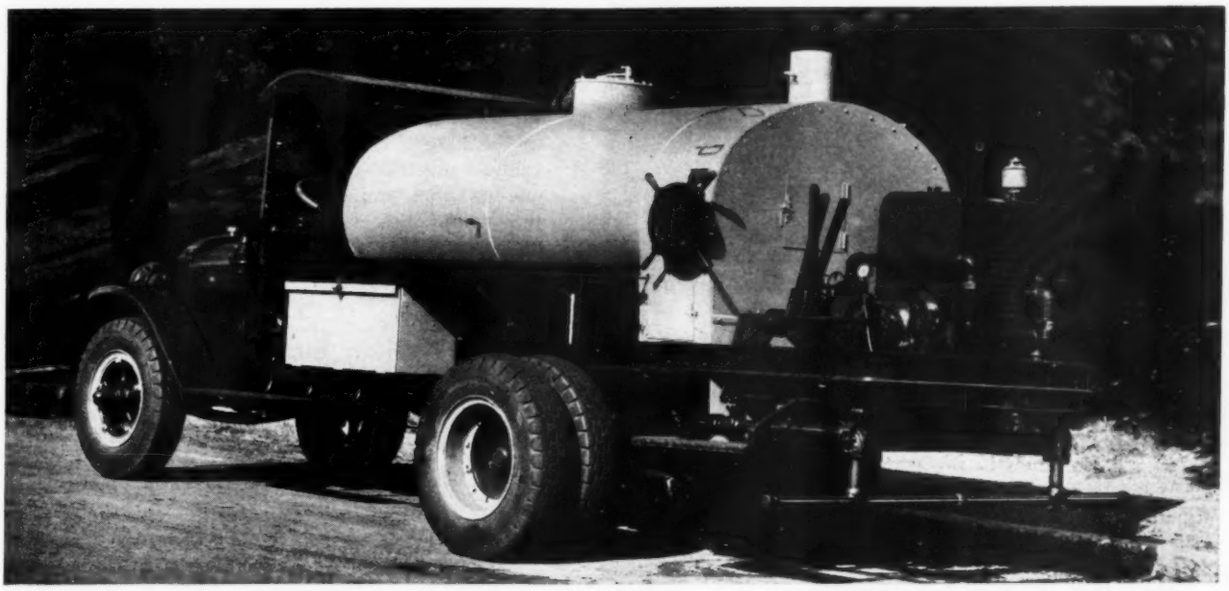

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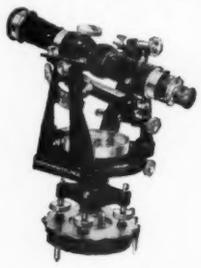

IN THE new Model Transit-Level recently introduced by the Warren-Knight Company there is offered to Municipal Engineers a combination Instrument that will do the work of a Transit at the price of a Builders Level. This Instrument has been tested by Engineers for City and Highway work, and found extremely satisfactory. The Instrument is light but sturdy and is built with the workmanship of a precision Transit. It offers many of the advantages of a Transit with the advantage of *adjustment like a Wye level*—an exclusive feature.

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cement concrete base under a sheet aspnalt pavement, however, has been allowed to crack at will. Many times this practice has resulted in ragged cracks of appreciable width running across the pavement. Very little information is available on this subject and the project is therefore attracting considerable attention. Several methods of using welded wire mesh were introduced in different sections of the pavement while unreinforced sections with weakened or dummy joints were constructed. In addition to the different designs in the base a change was made in the sheet asphalt surface mixture by adding about thirty per cent of one-half-inch stone to the top mix. It was hoped that this would fluff the mix, give better raking qualities and produce a smoother riding surface free from the shallow waves so common to sheet asphalt pavements. It is too early to gauge the results between sections laid with the different types of surface and base, but records of density, stability, type of reinforcement, etc., are being carefully kept which may prove valuable in future work.

Loadings for County Bridge Design

In designing bridges for county roads, no particular standard loading appears to be followed, judging from reports submitted by about 400 counties to PUBLIC WORKS. While many of these counties have adopted the bases of design of their respective state highway departments, or of the U. S. Bureau of Public Roads, more of them appear to follow their own inclinations, though doubtless their standards are, in many cases, based in a large measure upon state standards.

A review of the loading assumed for design reveals a considerable disparity of opinion, which is perhaps best expressed in the words of F. A. Steiger, county surveyor, Fairfield, Calif., who says: "I do not think that loadings should be limited. All bridges must be able to carry any load imposed, and truck drivers make no concessions." Similar statements were made by others, yet on certain roads there is no doubt but that the scarcity or absence of heavy truck traffic would make an exceedingly heavy type bridge unnecessary.

More counties use a design based upon a 20-ton loading for their main county roads than any other basis. Rather closely following is a 15-ton loading. Some few counties use loads of 30 or 40 tons for design purposes, sometimes in the form of two 15-ton trucks using the structure at once. Others use live loads of 100, 130 or 160 pounds per square foot. Some few counties, mainly in the south, use loadings as low as 6 to 7½ tons, even for their more important county roads.

But if the situation is scrambled when main county roads only are considered, it becomes still more so when secondary county roads are considered. Assumed loadings for design vary from a concentrated load of 4 tons to a concentrated load of 30 tons. Probably 40% of the counties use the same loading for sceondary road bridges as for main road bridges, but the majority of them do not. Concentrated loads of 10 and 15 tons are used for design bases by more counties than any other loading, though a 20-ton loading is used by a large number. Live loads of 80 to 160 pounds per square foot are used in a few cases. Loads of 4, 5, and 8 tons are used, but by a rather small percentage of the total.

Repaving Cuts in Concrete Pavements

By F. D. Woodruff

Assistant Superintendent of Maintenance, New Jersey State Highway Department.

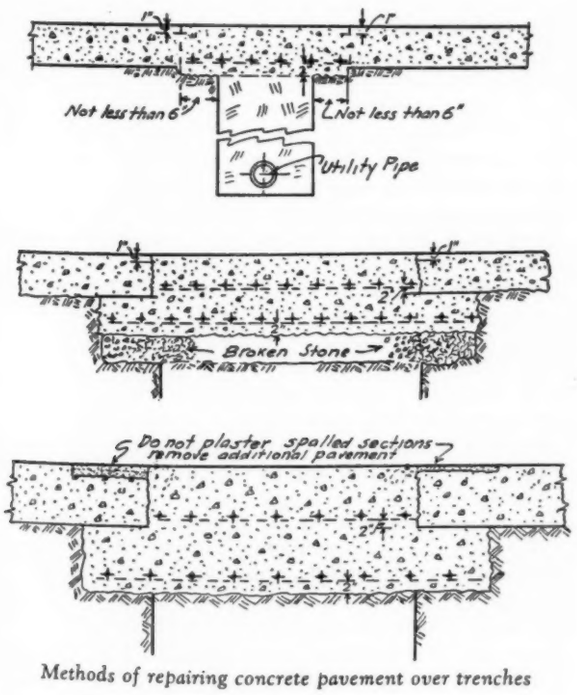
NEWLY constructed concrete pavements must be cured for a considerable period before being opened to traffic, but it would be extremely disadvantageous to close a heavy-traffic highway for such a period after every cut made to reach an underground pipe or for other reason. Fortunately the curing time can be reduced to 18 or 24 hours, or under strikingly adverse conditions not more than 72 hours. Where patches are to be opened to traffic in 18 hours, however, conditions must be almost ideal, workmanship must be of the best, and accelerating admixtures must be employed generally.

General Fundamentals

The use of special cements other than true portland cements is not recommended, since the former require unusual curing methods and treatment and therefore are not readily adaptable to average working conditions. Finely ground and specially burned portland cements are not always obtainable on short notice, and standard commercial brands are generally the only ones available for such emergency repairs. Care should be exercised not to use water showing strikingly undesirable characteristics.

The sand should be well graded in size, washed clean and completely free from all foreign material. Excessively fine material therein will usually require the use of additional water to produce a workable mix and in all probability will result in an inferior quality concrete.

The stone or gravel should contain no loam, vegetable matter or decomposed fragments. The size employed will depend upon the character and extent



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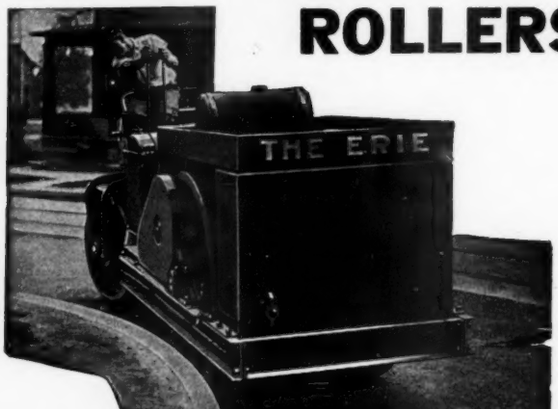

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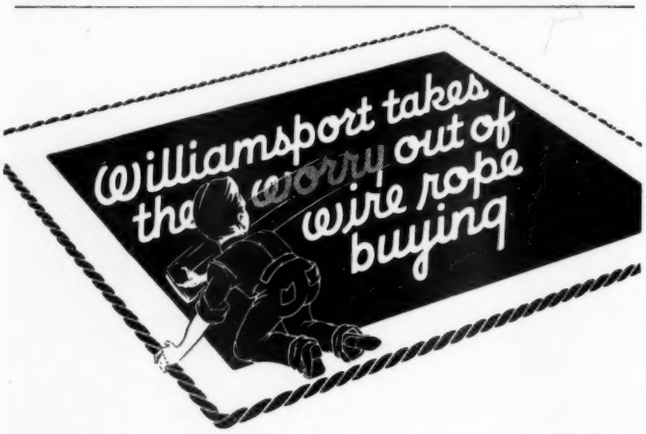

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of the repair section being treated; small sizes will develop better workmanship in small patches, while the standard larger graded aggregates are suitable for larger areas.

The determination of the void content of the coarse aggregate may not be made in emergency repairs, and an arbitrary mixture should be decided upon for average conditions. For general work this proportion should range between 1:1½:2 and 1:1¾:3½, the former mix being used for patches averaging two square yards or less, wherein a "three-quarter inch" coarse aggregate is preferable, and the latter for patches exceeding three square yards, in which larger aggregate should be used. Whatever mixture may be determined upon, it is essential to slightly increase the cement ratio in the composition of the repair section. This increase may be fixed at ten per cent, although during summer temperatures where admixtures are used flash set should be closely guarded against. Where the original composition of the pavement being repaired is known, the same mixture may be used in large repair sections.

Preparation of Subgrade

Utility Trenches—The concrete pavement should be removed for not less than six inches beyond the edge of the utility trench. The subgrade so exposed, if of the proper stability, should not be adjusted in any manner nor any foreign materials added to it except where it becomes necessary to remove unstable material for a depth in excess of six inches. Where doubt exists as to the quality of the underlying foundation the normal surface of the subgrade adjacent to the trench should be reduced for a sufficient depth to secure a substantial support which otherwise might be disturbed by the removal of the surface pavement to be repaired.

The backfill placed in the excavated trench must be thoroughly compacted by either flooding or mechanical tamping, carried out in layers not to exceed four inches thick where possible.

Surface Failures as a rule result from the use of inferior materials, poor workmanship, improper subgrade compaction or bad drainage. The repair section should be of such quality as to correct the inferior workmanship and material factors, while a simple inspection should determine the necessity of auxiliary lateral drains to secure good drainage. Where failures have occurred because of insufficiently compressed subgrade, it is essential to remove all material underlying the pavement which may give any indication of instability. Where the removal of the subgrade for a depth exceeding six inches becomes necessary, a thoroughly compacted sub-base of broken stone or other suitable material should be substituted. To overcome the possibility of such instability extending beyond the limits of the repair section, the subgrade under and adjacent to the section to be patched should be removed as far as possible and replaced with suitable material. While this treatment may not be as effective as the removal of additional surface area, it has been found that radiating progressive failures have been almost completely overcome by this procedure.

Replacing the Concrete

The edge of the concrete along the outside of the cut should be left rough and uneven, except that the top for not to exceed one inch should be plumbed. An edge plumbed and smooth for the entire depth invites early failure and a "punching out" of the patch. The only exception is where an expansion or

contraction joint is desired. If oil has penetrated the old concrete for a considerable depth no adhesion of the concrete can be expected, but a rough abutting edge will tend to hold the patch in position.

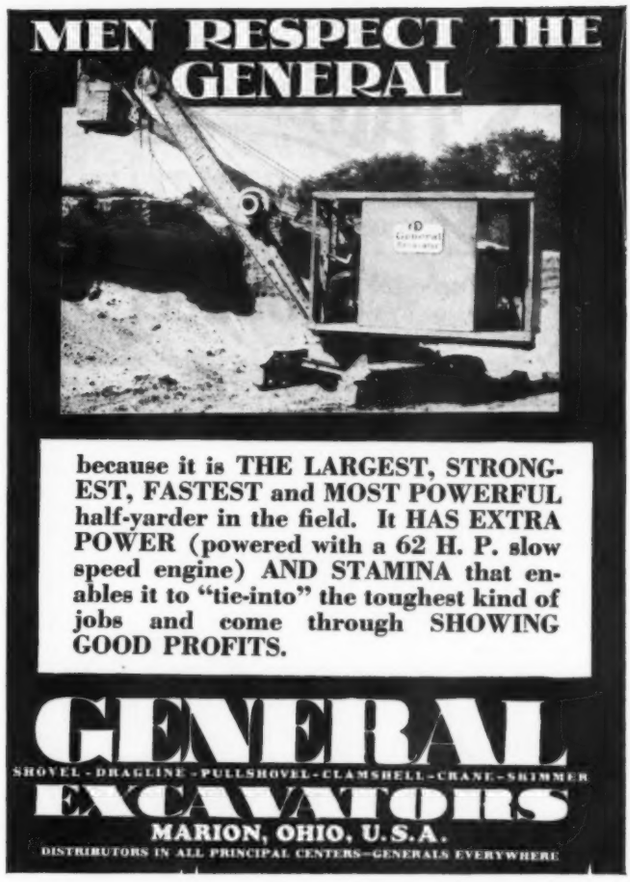
Spalled or scaled surface areas of the old concrete adjacent to the edge of the cut should not be plastered, as such shallow repairs will chip out quickly. In such cases it may be necessary to cut back the entire depth of the concrete under such spalled areas.

Reinforcing steel, preferably three-eighths inch diameter deformed, should be placed in the restored section two inches above the bottom of the slab. The amount of such reinforcement will depend upon the dimensions of the opening being repaired and upon the condition of the subgrade. In general the spacing of this reinforcement should conform to the spacing found in the old pavement, both transversely and longitudinally. Where reinforced pavements are encountered the existing reinforcement in the area of the repair should not be removed, but should be bent out of range of repair operations until the section is to be replaced, at which time the steel should be returned as nearly as possible to its original position and tied in with new reinforcement. Where unreinforced pavements are encountered a mat of bars not more than twelve inches center to center should be employed. Such reinforcement is of vital importance in restorations over service trenches. In case of extra-depth patches, two lines of reinforcement may be used.

Placing Concrete Mixture—The edges of the existing pavement should be thoroughly washed, wire brushed, wetted down and painted with a one-to-one mortar coating immediately previous to the placing of the concrete mixture. This treatment is quite essential at all times, but obviously more so with high summer temperatures, during which periods the edges must be completely cooled and saturated previous to the mortar coating, to be followed immediately by the installation of the concrete mixture.

Plain Concrete Mixture—The water content of any plain mixture should not exceed four gallons per bag of cement, less the moisture content of both fine and coarse aggregates. During certain periods of the working day a stock pile of either fine or coarse aggregate may contain much more water at the bottom than in the top and this condition must be carefully watched and the water added at the mixer drum adjusted accordingly.

The aggregates should be mixed from not less than two and one-half minutes to five minutes in a machine mixer. No hand mixing methods should be employed. The resultant mixture should flow from a square-pointed shovel with difficulty and no mixture showing more than a one-inch slump in twelve inches should be used in high-early-strength repair work. The four-gallon water-cement ratio mixture will, as a rule, produce a consistency which is called "unworkable." This "unworkable" mixture should be placed in the repair area in two-inch layers, each layer being thoroughly compacted by either manual or mechanical manipulation, the compacting being completed before initial set takes place. The final "dry" layer of concrete must be tamped sufficiently to bring out a workable surface, roughly planed and kept slightly above the finished grade. The final tamping and finishing of the surface should be done as late as possible in order that, practically speaking, the shrinkage of the concrete may be worked out prior to the time of setting up. The proper time for performing this final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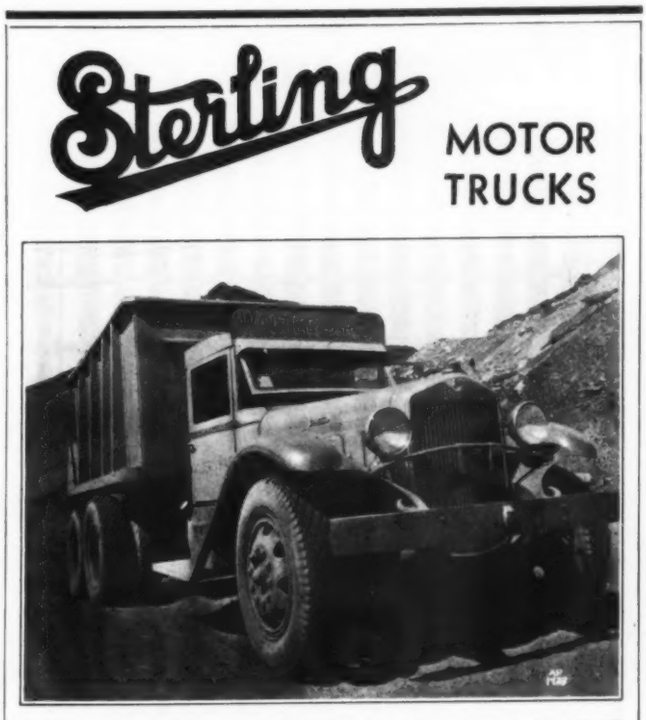

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operation will vary under different conditions and with different materials, but is best recognized by the surface drying up appearance of the concrete. At this point the surface should be tamped thoroughly, planed to grade and finished to proper surface. Unless the surface of the patch is retamped and finished at this later period, all bond may be lost. No proper bond can be expected unless the concrete mixture is reworked at this point, at which time the final shrinkage is about to take place.

Concrete Mixture with an Admixture—By using certain admixtures, concrete repair sections may be thrown open to traffic in twenty-four hours or less.

Calcium chloride and other admixtures of equal proven effectiveness which are not detrimental to the concrete may be used to advantage to secure high-early-strength at low temperatures. The use of calcium chloride only slightly reduces the freezing point and in low temperatures it is quite essential to heat not only the water, but the other aggregates as well. Neither should any concrete be placed upon a frozen subgrade.

A portland cement concrete mixture containing calcium chloride should contain no more water than that used in plain mixtures, but must be manipulated much more quickly in relatively high temperatures than the plain cement combinations, since initial set takes place much earlier; in consequence, the depth of the layers to be tamped should be increased to not less than four inches. The same procedure of finishing as used for plain concrete mixture should be followed just prior to the initial set, although at low temperatures there appears to be no difference between the action of a calcium chloride treated mixture and an untreated mixture in summer weather. The mechanical mixing time should not exceed two and one-half minutes in summer temperatures. Where the mixing time is in excess of this period, the mixture may set up in the drum of the mixer or before the final tamping of the repair section has been completed.

For rapid acceleration at temperatures above 70°, a 1½ per cent calcium chloride solution may be used; between 50° and 70°, a 2 per cent solution; 32° to 50°, a 2½ per cent solution; and from 24° to 32°, a 3 per cent solution. No two portland cements, however, react the same in combination with such an admixture, but for average working conditions these rules can be followed.

The admixture, if calcium chloride, must be added to the mixer drum in solution in order that a thorough distribution may be assured. If added in the dry state, isolated portions containing the admixture may occur, quickly setting up and not only fouling the mixer drum, but if placed in the repair section causing areas of unequal initial set. If a two per cent solution is required, a fifty-gallon container should be filled with forty gallons of water and to this should be added 100 lbs. of 75% calcium chloride and the mixture agitated until the calcium chloride is completely dissolved. Add sufficient water to bring the total solution to fifty gallons. A gallon of this solution added for each bag of cement will then produce what is known as a two per cent admixture, or two pounds of calcium chloride for each bag of cement. The water necessary to give the desired water ratio includes the amount used in the solution.

Curing

A concrete mixture containing calcium chloride, having been placed and finished to the proper surface, requires no careful curing, but during high tempera-

tures the finished pavement should be protected by burlap saturated at frequent intervals. In plain mixtures, the repair sections should be cured with wet hay or by the ponding method until the area is to be thrown open to traffic.

Economy of Creosoted Timber Highway Bridges

DURING 1931 the State Highway Department of North Dakota awarded contracts for seventeen bridges having a combined length of 867½ feet and costing $39,096.07; an average length of 51 feet and an average cost of $45.07 per lineal foot.

The first timber bridge on the state highway system was built in 1928—an eight-span trestle 137.5 feet long, costing $57.86 per lineal foot.

Since that first timber bridge, some rather expensive features of design have been eliminated and the contractors have become better acquainted with this type of construction, and in 1931 the average price per linear foot for creosoted timber bridges was a little less than half that for steel and concrete bridges.

Except for railings, all timber used in bridges on the State highways is pressure treated with creosote oil. All pieces are cut to fit right into place in the structure and about half of the necessary bolt holes are bored before the timber is treated. The old system of doing all the cutting and fitting on the job after the timber had been treated practically nullified the preservative treatment at bearings, joists, exposed ends, etc., where it is most essential to have it. By framing and boring the timber before treatment, the full value of the preservative treatment is realized. The cost of the treatment is about twenty per cent of the cost of the timber complete in place in the structure.

On timber bridges as they are now designed and built on State highways, the chief items of maintenance are: keeping the wearing surface adequate to protect the floor from the direct wear of traffic; keeping all bolts and connections tight, and keeping the ground underneath and adjacent to the bridges free from grass and weeds so as to reduce the fire hazards. These are all comparatively small items in themselves but they require rather constant and regular attention.

Even though creosoted, timber bridges are not permanent; but it is believed by Clifford Johnson, bridge engineer of the North Dakota State Highway Department, that they will last 40 or 50 years or more. Timber bridges are not fire proof, but the number that have been destroyed by fire in North Dakota is extremely small.

Where bridges have to be relocated to improve the alignment, widened to provide for increased traffic volume, or lengthened to provide for unforeseen drainage requirements, these adjustments can be made easily and with a minimum of waste. In case of relocation, a timber bridge can be moved with practically no loss of materials.

There is no need of construction work on timber bridges being seasonal for they can be built in winter as well as in summer without any extra precautions or protection. The advantage of quick construction and immediate opening to traffic depends of course upon whether or not the adjacent highway is ready for traffic.

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Snow Control and Removal

Snow Removal in South Dakota

By J. H. Lake
Highway Engineer, South Dakota Highway Commission

SNOW removal on the state trunk highways of South Dakota is under the supervision of the district engineers, who personally organize the crews and plan the work in some counties, while in others this is done by the county highway superintendents. Snow removal is started as soon as practicable after a storm. It is, however, a mistake to start this work until after the storm has subsided, especially when it is accompanied by a strong wind. Snow removal attempted at this time is not only a waste of money but it aggravates the condition by heightening the snow wall along the road and increasing the amount of snow that it will be necessary to remove after this storm and other storms that may follow. The incessant demand of the public for open roads at all times causes snow removal to be started in a good many instances before it should be. However, the gas tax that is lost when the road is blocked with snow in most cases is more than the cost of removing the snow, so that snow removal really pays for itself.

The equipment that can be used most effectively in snow removal depends upon the type of road and the amount and character of the snowfall. A light snow can be pushed off the travelled portion of the roadway with blade graders or road maintainers. When the limit for this equipment is reached the truck plow is used. This type of snow plow has the advantage of speed and mobility. A speed plow mounted on a fast, powerful truck will not only push the snow from the roadway, but will throw it a considerable distance and to a certain extent prevent the piling up of snow along the highway, which is always hazardous as it makes a channel which will drift full with each wind storm and block the highways. The deep heavy snows are most effectively removed with a tractor plow. This equipment is slow to move from place to place but is powerful and pushes its way through, piling up the snow along the road. The rotary plow is used mostly in deep cuts and to widen out after the other types of equipment have piled the snow along the road and no more storage space is available. This type of plow is especially adapted to this work as it will throw the snow a considerable distance.

The past winter was the most severe of any since the policy of keeping roads open all winter was adopted. The State Highway Department owns 66 truck plows, 69 tractor plows, 5 rotary plows. These, in addition to numerous county plows, were in almost constant use night and day, for ninety days. Snow removal over that period cost the state approximately $200,000, which is far in excess of any previous annual cost.

It has been said that the best kind of snow removal is snow prevention. That is, not allowing the snow to drift or lodge on the highways. This can be accomplished to a certain extent in three ways: snow fences, weed maintenance, and proper road design. Snow fence if properly placed will control drifting. However, it must be placed by taking into account the topography of the land, the cultivation adjacent to the highway and the direction of the prevailing winds. A section of highway may be bothered with drifts this winter because of an adjacent plowed field from which the snow sweeps, but next winter this may be a field of standing corn from which very little snow will blow. The prevailing winds in this state are from the northwest, but during the past winter several bad snow storms came with a south or east wind. In these instances the one million feet of snow fence which we had erected not only was worthless but in some cases caused drifts to start and block the highways. The cutting of weeds along the shoulders in the ditches and along the fence lines is very essential as they very readily cause drifts to form. Road embankments that otherwise would have been swept clear of snow will be blocked by drifts caused by weeds growing along the shoulder.

Our roads are now being designed and constructed to prevent as much snow trouble as possible. High fills on which snow cannot readily lodge, with wide ditches and borrow pits to catch and hold the snow, make the roads which we are constructing today much less liable to give us snow trouble except in unusual cases.

As practically all our roads are surfaced with gravel we are not bothered a great deal with icy roads. When we are, we spread sand or gravel over the icy portions.

When to Start Planning for Snow Removal

By Frank T. Sheets
Chief Highway Engineer of Illinois

Planning and organization for snow removal should be done during the late summer or fall months. If a snow storm should occur before the organization is developed, there is confusion, resulting in loss of time and inefficient work. This Department follows the policy of having all preparations completed for snow removal by the middle of October or the first of November.

Snow Removal Equipment Operated by Pennsylvania

The Pennsylvania Department of Highways owns and operates the following equipment (as of the winter of 1931-32), which is employed on snow removal work: 708 motor trucks, for which there are provided 649 mold-board plows, 141 V-type plows, and 8 rotary plows. There are 117 tractors, for which there are available 81 V-type plows and 18 rotary plows. The excess in the number of tractors over that of tractor plows indicates supplementary power units available for tandem hook-up.

Snow removal work in Pennsylvania is supervised by the Highway Department's maintenance organization operating through maintenance districts. Except in two instances, these maintenance districts coincide with county limits.

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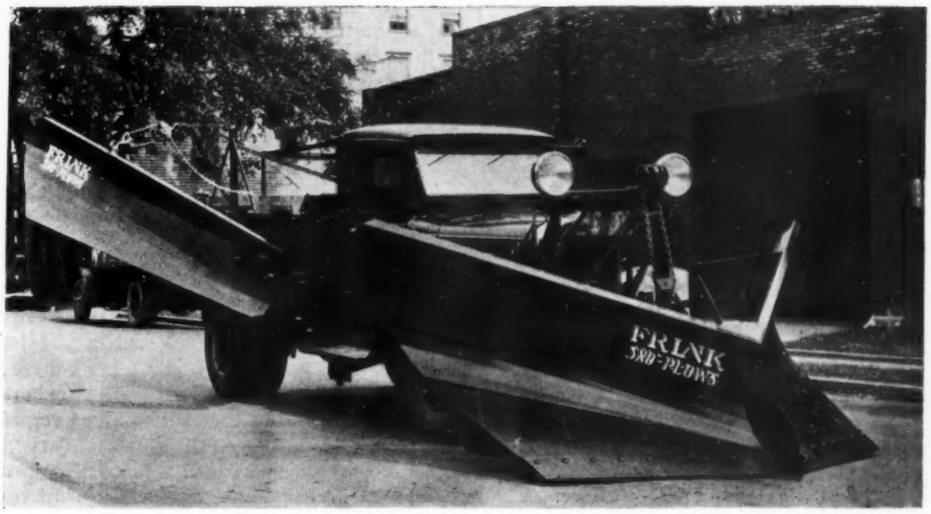

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THE answer to the snow removal problem simmers down to well defined facts which are governed by the answers to the following questions: 1. What type of motive power is available for snow removal work? 2. From what type of roads is snow to be removed? 3. What are the average and maximum depths of snow which will have to be removed? 4. What is the mileage of roads from which snow will be removed? ¶ FRINK Sno-Plows are adaptable to a greater variety of the above conditions than any other snow plow because there is a greater variety of sizes from which to select and because they are designed by one of the pioneers in the manufacture of snow removal equipment, after years of experience and intensive study of all kinds of snow conditions from the Arctic regions of northern Canada to the southern limits of the snow belt in the United States.

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Does Snow Removal Pay?

Engineers from eleven states in the snow belt discuss herein the economic and other advantages of snow removal. The statements below are essentially direct quotations from the man responsible for snow removal in each of the states.

CONNECTICUT.—Snow removal does pay; the public appreciates it. There is no way of estimating the value of this service to Connecticut motorists in dollars and cents. The cost for the fiscal year 1930-31 was approximately $164,500, covering 2280 miles of road—slightly over $72 per mile.

IDAHO.—Snow removal pays in benefits to the public. In ordinary winters, the difference in income from gas tax pays the snow removal cost. Our ordinary costs run about $100,000, but the last season was exceptionally severe and the cost totalled about $250,000.

NEVADA.—The public demands more snow removal each year, and we believe it best to remove the snow from our oiled highways as rapidly as possible. For the winter of 1931-32, 1,693.96 miles of highway were kept open for traffic at a cost of $82,678.95, an average of less than $50 per mile.

MASSACHUSETTS.—The cost for snow removal in Massachusetts is approximately 62 cents per vehicle. The demand by the public for such removal is very great.

PENNSYLVANIA.—It is estimated that the costs of snow removal in Pennsylvania are saved in the protection of surfaces and shoulders, particularly surfaces of the flexible type. The snow removal program in Pennsylvania has been increased in mileage from year to year, in recent years including all hard-surfaced mileage of the State Highway System. The total expenditures by the Pennsylvania Department of Highways, for snow removal and incidental work during the winter of 1931-32, was $1,196,462, an average of $111.66 per mile of program. Included were costs of $36.29 a mile, or $388,895, for snow removal; $33.00 per mile, or $353,608 for snow fence, rental value and costs of handling; and $42.37 per mile, or $453,958 for spreading cinders on icy roads.

SOUTH DAKOTA.—The incessant demand of the public for open roads at all times often causes snow removal to be started before it should be. However, the gas tax that is lost when the road is blocked with snow is, in most cases, greater than the cost of removing the snow, so that snow removal really pays for itself. Design to prevent drifting, snow fences, and weed maintenance are also employed.

RHODE ISLAND.—Many benefits gained by keeping highways open through the winter are self-evident, but difficult to estimate from the dollars and cents viewpoint. In Rhode Island the traffic on our state roads is heavy the year around. Before snow removal on our state highways, many, if not most, of our motorists put up their cars for the winter. Car owners now use their cars for the full twelve months. Undoubtedly there are immense benefits to social, religious, educational and business activities as a result of keeping the roads open.

NEW HAMPSHIRE.—It seems evident that the removal of snow in this state has paid from the fact that before snow removal 75 per cent of the registered automobiles were not registered before the first of January, and probably most of these not before the first of May, whereas now fully 75 per cent are registered before the first of January for the following year. It appears safe to assume that the increase in the gasoline tax income which is shown during the months of January, February and March is directly attributable to the fact that the roads are kept open by snow removal. This increase is very much in excess of the state snow removal budget, which allows an average of $100 per mile.

IOWA.—Snow removal undoubtedly pays though there are no definite figures to back up this statement. There is a strong public demand for snow removal, and in 1931 the state spent $426,549 for this work, including the cost of new equipment.

VERMONT.—The public demands snow removal. Costs last year were approximately $60,000 for winter maintenance on 1,000 miles of road, which included not only snow plowing, but sanding, opening culverts, ditches, etc.

MICHIGAN.—Probably no single phase of highway maintenance work has had more rapid development, or has been more appreciated by the motoring public, in the past decade, than snow removal work. This decade has witnessed the almost complete abandonment of interurban railway service, as well as many branch lines of railroads. Winter maintenance on all of the main northern Michigan highways has infused new life into the business and social activities of that part of the state. It has made possible the more extensive development of the centralized school system and has provided means for medical service in isolated regions. The average annual cost of wheel traffic snow removal on the State Highways of Michigan for the past nine years has been $69.50 per mile.

It is no longer sufficient to keep roads merely in such condition that traffic can get through. They must be cleared wide enough for two-way traffic, and the surface kept smooth and free from snow and ice ruts.

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Sanitary Engineering

Water Supply—Sewerage—Refuse Collection and Disposal—Sanitation

Devising Color Standards for Residual Chlorine

By E. C. Meredith

Asst. Engr. Virginia State Department of Health

For controlling the dosage of chlorine in water many operators desire only one or perhaps two color standards since they are not interested in the exact residual chlorine present, except to maintain it at the desired figure.

It has been the custom of this department to supply the operators in the state with standards for a residual chlorine content of 0.2 p.p.m. as that is about the residual which they wish to maintain. However, it has been found that these solutions as made up according to Standard Methods lose their color upon standing and have to be replaced rather frequently. In looking for a way in which to obviate this, it was discovered that some of the toilet preparations have practically the same color as that obtained when testing for residual chlorine. The preparation used was a shaving lotion known as Williams Aqua Velva which has a color equivalent to a residual chlorine content of about 0.25 p.p.m. A bottle of this solutation which has been allowed to stand for approximately three months has shown no appreciable change in either intensity or shade of color, and it is believed that it will remain unchanged so long as it is kept tightly corked.

There are many other preparations of a similar nature which have about the same color and it is quite probable that one could be obtained which would have a color exactly equal to a 0.2 p.p.m. residual chlorine.

The simple testing outfit consists of two small bottles, a bottle of Ortho-Tolidine, and a medicine dropper. The bottles should have a capacity of about one ounce, and should be of clear glass and preferably rectangular in section.

A Small Sewage Disposal Plant

In connection with the policy of maintaining good sanitary conditions in the resort areas of New Hampshire, a sewage treatment plant for the store, gift shop and restrooms near the Old Man of the Mountain in Franconia Notch was installed by the Forestry Department and the Society for the Protection of New Hampshire Forests, the work being done under the supervision of L. W. Traeger, Assistant Sanitary Engineer, State Board of Health.

The store and restrooms are located about 50 feet west of the Daniel Webster Highway near The Profile Lake in Franconia Notch and 1,164 feet south of the new underpass and walkway from the parking place. The ground surrounding the building was very swampy and therefore unsuitable for the disposal of any sewage, which made it necessary to install a retaining and pumping outfit. A septic tank is used as a preliminary treatment and its dimensions are 9′ x 6′ x 7′. The retaining tank has a capacity such that pumping of the sewage can be done once a day. The dimensions of this tank are 9′ x 12′ x 6′.

When this disposal plant was first installed a gasoline type Fairbanks-Morse centrifugal sewage pump was used. This has recently been replaced by automatic electric apparatus. A receiving chamber was installed at a distance of 600 feet from the pump pit, and used as a distribution chamber. As the sewage is received in this chamber it flows over a weir which divides the flow into three equal quantities. From this chamber there are approximately 850 feet of 4-inch drain tile leading to trenches about 30 inches below the surface of the parking space on the west side of the highway. This plant was designed to take care of from 3,000 to 4,000 gallons of sewage per day.

Metering Water Used by Gas Refrigerators

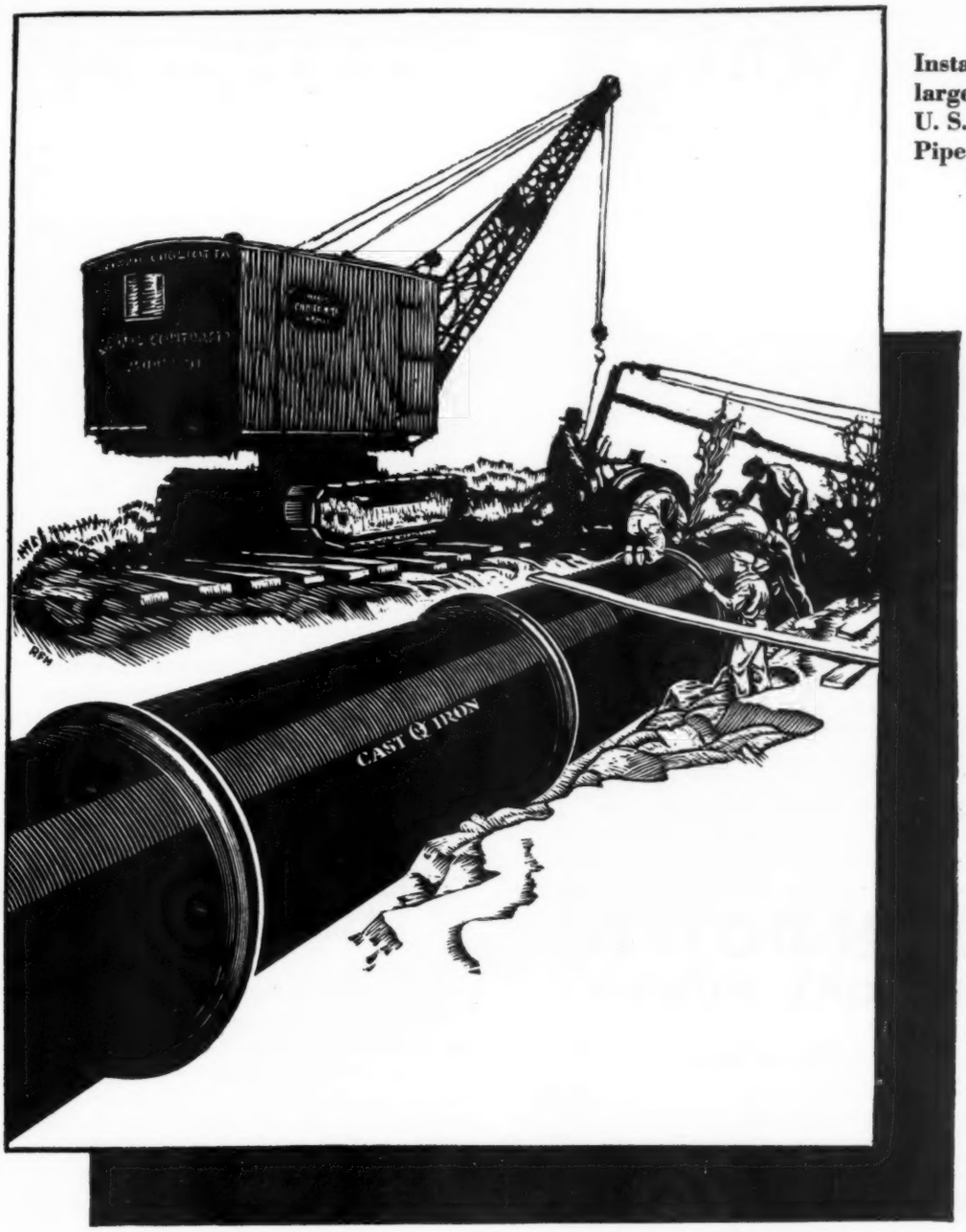
The average small gas refrigerator uses from 100 to 200 gallons of water per day. This amount is, as a rule, too small to cause house meters to register, and represents a dead loss to the water department. The question of how to overcome this problem was discussed at a recent meeting of the Maryland-Delaware Water and Sewerage Association.

H. R. Hall of the Washington Suburban Sanitary District, Hyattsville, Md., reports that tests show that the amount used will not register on the average ⅝-inch meter. It is thought that this unregistered use may be met by an increase in the service charge equal to the estimated consumption of water by the refrigerator; or meters may be developed that will register this small flow. C. A. Hechmer, of the same organization, further stated that experiments were being made with a new meter to determine if it will register, and that attempts were also being made to develop a small meter as a part of the refrigerator. J. R. Cronister of the Dorchester Water Co., Cambridge, Md., stated that in Cambridge most of the gas refrigerators were in the larger buildings, and used enough water to cause the meter to record the flow.

Garbage Disposal Costs in Sharon, Pa.

The Bureau of Garbage of Sharon, Pa., which is under the charge of Lewis E. Burnside, city engineer, keeps unusually complete records of its operations and expenditures.

The garbage, together with combustible refuse, is collected by city-owned trucks and destroyed in an incinerator. Ashes and cans are collected on call by the householder. The population of 26,000 in 1930 provided 4,429.5 tons, which was burned in the incinerator, 240 tons of slack coal being used to aid combustion. The cost of operating the incinerator was



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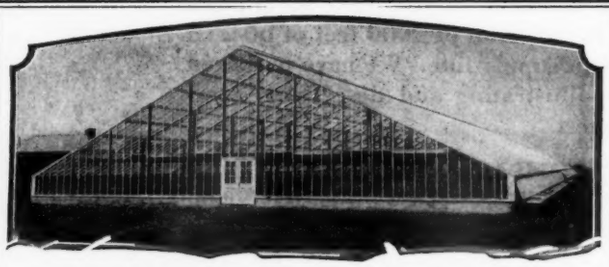

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$2,260 for labor, $594 for fuel, $347 for upkeep and repair, $1,395 for superintendence and other overhead, and $205 for gas, water, light and office supplies; in addition to which $3,850 is estimated as interest and depreciation. This gives a total of $1.95 per ton incinerated, or $1.08 per ton omitting interest and depreciation. Collection cost $11,158 for collecting 4,353 tons (76.5 tons of refuse were brought to the incinerator by private parties), or $2.56 per ton.

Ford 1-ton trucks are used for collection, and a separate account is kept of each. How complete this is may be illustrated by the account of one truck for the year. This truck worked 294 days, made 1,844 trips, hauled 2,199.7 tons of incinerator refuse and 44 loads of ashes and cans, traveled 6,562 miles, lost 1 hour, and traveled an average of 3.5 miles per trip. Its operation costs were $181.72 for 1,060 gals. of gasoline, $13.75 for oil and grease, $209.14 for repairs, and $1,314.61 for driver; a total of $1,719.22. Its general costs were $96.22 for interest, insurance and garage, $232.90 for depreciation (charged at $0.0355 per mile), and $161.21 tire charge (2.5 cts. per mile). This gives a total of $490.36 general charges.

The unit costs are figured as follows:

	Per day	Per ton	Per mile	Per ton-mile
Operation	$1.37	$0.18	$0.06	$0.05
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Using a light grade of kerosene, the brushes broke the oil too finely and the brushes were removed, giving better distribution. Later a 24° diesel oil was used. This appeared to be a little too heavy, and it was felt that oils of 27 to 30-degree gravity would be better. Oils lighter than 30-degree would probably be lost in part by evaporation of the more volatile portions. Oil effectiveness may also be increased by admixture of 1% or 2% of high-temperature distillation cresylic acid.

On this test, 302 gallons were applied to an area of about 19 acres, or at the rate of 16 gallons per acre. However, some oil was probably lost due to drift, and the appearance of the marsh indicated that the effective application was not more than 10 gallons per acre. That this was effective was shown by examinations next morning which indicated practically 100% kill of *Aedes dorsalis* larvae.

It should be noted that the amount of oil applied was very much less than is generally considered necessary. In few places has it been desirable to apply less than 50 gallons per acre. The killing power of the oil, of course, has much to do with the amount required, as does the cost of application. If oil costs 10 cents a gallon, since it is likely that

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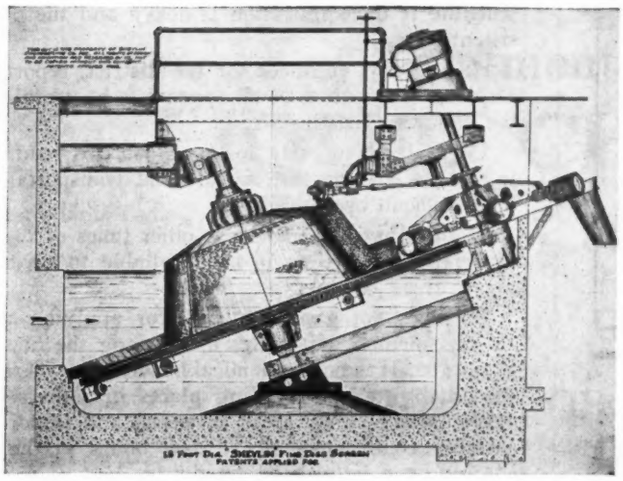

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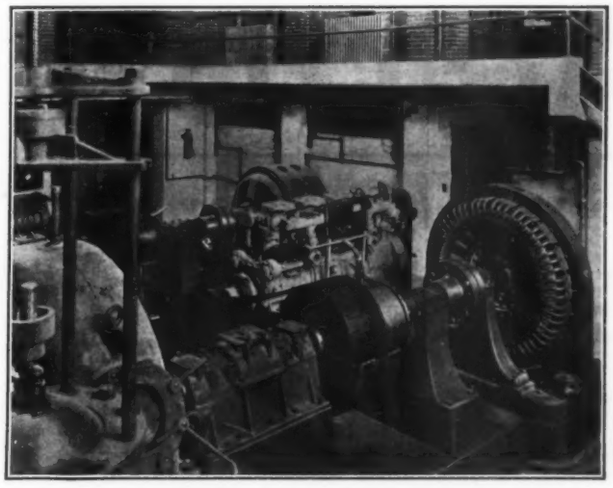

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application by knapsack sprayers will cost around 25 cents a gallon, it is desirable to put on more oil, probably as much as 100 gallons per acre, and trust it to remain for a longer period. In some cases, oiling may be carried out effectively on a 21-day schedule if the application is heavy and the oil persistent.

H. F. Gray, engineer for the district, reports that airplane distribution of oil appears to be useful under the following conditions:

1. In oiling in early spring, when dirt roads leading to the marshes are so soft that transportation of oil is difficult or impossible.

2. In oiling large areas at other times of the year, especially when time is not available to cover such large areas on foot.

He does not give cost data for applying the oil by this method, but states that among the disadvantages are: It is not economical or effective where there are small isolated breeding places in a marsh, with large non-breeding areas between; and under usual weather conditions, only a few hours in the early morning can be utilized for flying.

The Water Wheel

(Continued from page 10)

pre-chlorinated (14.3 lb. per m. g.), treated 0.9 gr. per gal. of alum, and then with 0.3 gr. per gal. of activated carbon; then it is filtered and 2.0 lb. per m. g. of chlorine and 0.7 lb. of ammonia are used to maintain a chlorine residual throughout the distribution system. Ammonia-chlorine treatment originally tried instead of activated carbon did not remove algae tastes and odors.

Chicago is conducting extensive tests on purifying lake water in an experimental plant,[25] using alum, lime and iron sulfate, sodium aluminate and others; determining time of mixing and settling, type of basins, size and depth of sand in filters. "Almost as much time has been given to experiments on *taste and odor removal* as on the other work. . . . Several methods of removing objectionable tastes have been developed, and as a result it is now possible to remove practically any taste-producing compound likely to be found in water used for a public supply. . . . Carbon appears to be the only hope of removing some of the taste-producing compounds which may be expected in the lake water off Chicago. . . . It is very likely that ammonia will be used as a part of the treatment." Super-chlorination followed by dechlorination removed a large percentage of the tastes but not all, and the same is true of potassium permanganate.

Chemistry of water purification. W. L. Mallmann describes[32] experiments conducted to determine the significance of the pH of water where chemical purification is used, especially chlorination. The conclusion was that "1. The reaction of a water influences the germicidal activity of the chlorine. 2. Increasing alkalinity causes a decreased germicidal activity of the chlorine with an increasing time period for death of the bacteria."

Coli-Aerogenes group determination by use of brilliant green bile broth is described [31] by H. E. Jordan, who "Ventures the assertion that when water works and public health laboratories have had a reasonable length of experience with the suggested procedure, it will be clear that no lessening has been made in re-

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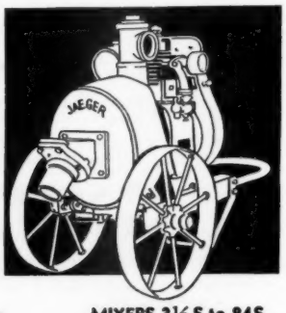

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quirements for good quality in water and material gain has been made in the speed of obtaining reasonably accurate information."

Bibliography of Recent Water Works Literature

c indicates construction article; *n*, note or short article; *t*, technical article.

American City, August.

1. *t.* Construction Joints of the Fridley Conduit. Leonard N. Thompson, p. 7.
2. New Water Works for a Louisiana Parish. Henry A. Mentz, pp. 67-68.
3. Overcoming Tastes and Odors in Impounded Water. James J. Caird, pp. 69-70.
4. *t.* Special Water Rates at Resort Cities in New Jersey and Florida, pp. 75-76.

The Canadian Engineer, July 12.

5. *n.* Water Consumption in Ottawa, p. 34.

JULY 19

6. *n.* Dorval Filtration Plant Opened, p. 49.

JULY 26

7. New Water Supply for the City of Vernon, B. C. J. C. Agnew, pp. 11-13.

Civil Engineering, August.

8. *t.* Dual Use of Buttress Dams. Calvin V. Davis and Franklin Hudson, Jr., pp. 472-475.
9. *t.* Deflection in Swiss Dams Measured. Fred A. Noetzli, pp. 489-493.

Construction Methods, July.

10. *c.* Motorized Equipment Averages 10,000 Yards a Day in Building Rolled Earth Dam, pp. 30-32.
11. *c.* Wire Saws Cut Rock Trench for Dam. C. B. Cornell, pp. 38-39.

Engineering News-Record, July 14.

12. *t.* Additional Vacuum Tank Solves Difficult Suction Lift Problem. Edward I. McCaffery, p. 38.

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13. *c.* Provo Equalizing and Storage Reservoir. C. J. Ullrich, pp. 63-65.
14. *t.* Hoover Dam Penstocks Set Record for Size, pp. 79-80.

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15. *c.* Water Line of 60-Inch Steel Pipe Pulled Across Mississippi River. C. C. Wilbur, p. 99.
16. *c.* Large Equipment Units Speed Tunnel Work (Boston Water Supply), pp. 107-108.
17. *n.* Data on Dam Uplift Wanted by Committee on Dams, A. S. C. E., p. 112.

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18. *t.* Estimating Groundwater Yield Similar to Reservoir Problem, p. 125.
19. *c.* Belt Conveyors Place Concrete for Vermont Dam in the Alps. Bruno Widman, pp. 126-129.
20. *t.* Forecasting Snow Runoff of Humboldt River, Nevada, pp. 135-136.
21. *t.* Progress in Filtering the Water Supply of Chicago, pp. 137-138.

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22. *t.* Uplift Pressure Measured at Gibson Dam. Ivan E. Houk, pp. 196-198.
23. *t.* Effect of Lead Joint Heat on Bituminous Pipe Lining. Elson T. Killam, pp. 199-200.

Ingenieria (Mexico), *June.*

24. *t.* Coeficiente de Contraccion. Pedro J. Dozal, pp. 182-183 and 209-212.

Journal, American Water Works Association, July.

25. *t.* Progress Toward Filtration in Chicago. Myron B. Reynolds and Arthur E. Gorman, pp. 965-983.
26. *t.* Corrosion in Neutral Waters. Ira D. Van Giesen, pp. 984-994.
27. The Springton Dam and Reservoir. H. S. McCurdy, pp. 995-1004.
28. Instrument and Control Equipment for An Elevated Storage Tank. Homer Rupard, pp. 1005-1008.
29. *t.* Winter Operation of Water Works Systems. J. Clark Keith, pp. 1009-1017.
30. Twenty-five Years in Retrospect (History of Indiana Section). F. C. Jordan, pp. 1018-1026.
31. *t.* Brilliant Green Bile for Coli Aerogenes Group Determination. H. E. Jordan, pp. 1027-1053.
32. *t.* Hydrogen Ion Concentration in Disinfection by Chlorine. W. L. Mallmann, pp. 1054-1061.
33. *t.* Cotton Guard Rope in Swimming Pools as Source of Colon Aerogenes Group. H. W. Leahy, pp. 1062-1065.
34. Typhoid Fever in the Large Cities of the United States in 1931, pp. 1066-1076.

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35. *t.* Some Quantitative Odor Determinations. Chas. H. Spaulding, pp. 1111-1118.
36. Operating Economies in Water Works Systems. W. E. MacDonald, pp. 1119-1131.
37. *t.* Water Hammer and Surge Tanks. A. W. F. McQueen, pp. 1132-1146.
38. The Water Resources of Maryland. Abel Wolman, pp. 1147-1151.
39. *t.* Observations on Utility Finances and Accounting. John W. Cunningham, pp. 1152-1164.
40. The Boulder City, Nevada, Water Works. Earl M. Kelly, pp. 1165-1172.
41. Purification of Snake and Clearwater Rivers. W. P. Hughes, pp. 1173-1177.
42. Chlorination of Water Supplies in the State of Washington. H. W. Nightingale, pp. 1178-1182.
43. "Tuning In" on Your Consumer. Mary Symms, pp. 1183-1189.
44. Design and Operation Data on Large Rapid Sand Filtration Plants in the United States and Canada. Eugene A. Hardin, pp. 1190-1207.

Journal, New England Water Works Association, June.

45. Chlorination for Special and Emergency Purposes. J. D. MacMahon, pp. 121-132.

46. Water Works Emergencies From the Health Standpoint. Warren J. Scott, pp. 133-137.
47. Meeting Emergencies Resulting From Breaks in Water Mains. Symposium, pp. 138-142.
48. *t.* Construction Layouts and Location of Gates of Value in Emergencies. Samuel H. MacKenzie, pp. 143-145.
49. *t.* Tuberculation of Mains As Affected by Bacteria. H. G. Reddick and S. E. Linderman, pp. 146-169.
50. *t.* Are Further Studies Needed on the Relation of Forests to Water Supply in New England? C. Edward Behre, pp. 170-183.
51. Water Works in Cuba. John F. Pierce, pp. 184-195.
52. *t.* Accounting for Water Districts. James W. Graham. pp. 196-200.
53. *t.* Unaccounted-for Water in Norwood, Mass. C. A. Bingham, pp. 201-203.
54. The Nashua Fire of May 4, 1930. Wm. F. Sullivan, pp. 204-213.
55. Effect of Present Economic Conditions in Massachusetts Upon Water Supplies. Arthur D. Weston, pp. 214-216.
56. Relief of Unemployment at Leominster by Water Works Activities. W. Guy Classon, pp. 217-218.
57. *t.* Proposed American Tentative Standard on Cement Mortar Lining for Cast Iron Pipe and Fittings. Committee on Specifications for C. I. Pipe, pp. 224-228.

Journal, Southeastern Section, Am. Water Works Assn., 1932 Meeting.

58. Advances and Developments in Powdered Activated Carbon Application in Water Treatment. F. E. Stuart, pp. 5-16.
59. *t.* Turbidimeters in Use at the Atlanta Filtration Plants. Paul L. Weir, pp. 17-23.
60. Wells and the Part They Play in Our Water Supply. W. R. McGrew, pp. 24-34.
61. Water Softening Plant, Thomasville, Ga. Lowell Cady, pp. 35-44.
62. Our Streams and Their Flow. E. D. Burchard, pp. 45-60.
63. The Water Supply of Spartanburg, S. C., and Its By-products. R. B. Simms and J. K. Marquis, pp. 61-68.
64. Water Works Accounting. Hilary H. Gardner, pp. 69-73.
65. Information on Water and Sewage Works Problems—Where It Can Be Found. Linn H. Enslow, pp. 74-84.

Manufacturers Record, August.

66. *c.* $2,500,000 Prettyboy Dam; An Engineering Feat, pp. 26-27.

Proceedings, American Society of Civil Engineers, August.

67. *t.* Forests and Stream Flow. W. G. Hoyt and H. C. Troxell, pp. 1037-1066.
68. Public Supervision of Dams. A Symposium, pp. 1081-1090.

Proceedings, Engineers Society of Western Pennsylvania, May.

69. Pymatuning Reservoir Project. Charles E. Ryder, pp. 103-153.

Proceedings, Maryland-Delaware Water and Sewerage Assn., 1932 Conference.

70. The Proper Relation Between the Medical Health Officer and the Water Department. Harvey H. Weiss, pp. 64-68.
71. Influences of Soils, Rocks and Minerals Upon the Potability of Water. J. J. Shank, pp. 69-77.
72. *t.* Waste and Stored Water Supplies, With Particular Reference to Ashland, Pa., and Cumberland, Md. H. E. Beckwith, pp. 78-86.
73. Developments in Powdered Activated Carbon in Water Plants During Recent Months. F. E. Stuart, pp. 87-95.
74. *c.* The New Thomas W. Koon Dam. Herschel H. Allen, pp. 96-111.

The Surveyor and Municipal and County Engineer (England), July 8.

75. Fylde District Water Supply, pp. 23-24.
76. Water Purification Methods at Bournemouth, p. 24.

AUGUST 5

77. *t.* The Internal Corrosion of Cast Iron Water Mains. W. R. White, pp. 120-121.

La Technique Sanitaire et Municipal, July.

78. Prevision Rapide des Crues de la Seine et Moyens de Faciliter l'Ecoulement des Eaux a Paris. M. E. Maynard, pp. 147-149.

Water Works Engineering, July 27.

79. The Water System of Java. Walter Buchler, pp. 898-900.
80. *t.* Some Sources of Water Waste and Methods of Abatement. Thos. J. Skinker, p. 900.
81. *t.* Laws Regulating Sale of Water. Leo T. Parker, pp. 901-903.
82. *t.* Water Softening by Zeolites, As Used in Municipalities. S. B. Applebaum, pp. 906-911.
83. *t.* Handling Common Water Complaints. Symposium, pp. 912-914.
84. *t.* Computing Pump Efficiencies by Direct Test Measurement. Thos. G. Myers, pp. 918-922.

AUGUST 10

85. *t.* Unusual Filter Plant Features at Kempton Park, London. Maj. F. Johnstone Taylor, pp. 952-953, 978.
86. *t.* Pressure Losses in Services. H. W. Niemeyer and J. A. Bruhn, pp. 954-959.
87. *t.* Numerical Rating of Public Water Supplies, From Public Health Standpoint. E. Sherman Chase, pp. 961-965.
88. Effect of Depression on Water Collections. Symposium, pp. 966-970.

Miscellaneous Reports.

89. *t.* Outline of Methods for Estimating Ground Water Supplies. Oscar Edward Meinzer. Water Supply Paper 638C; U. S. Geological Survey. 144 pp.
90. *t.* Loads on Pipe in Wide Ditches. W. J. Schlick. Bulletin 108, Iowa Engineering Experiment Station. 48 pp.

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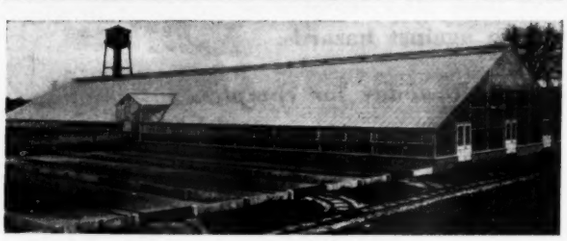

Sewage Disposal Plant at

BLOOMINGTON AND NORMAL, ILL.

A LORD and BURNHAM glass-over for covering some of the sludge drying beds is a feature of that sewage-works for the Bloomington and Normal, Ill., Sanitary District, designed to serve a population of 54,000.

The sludge beds provide an area of 0.744 sq. ft. per capita for the estimated population of 1955. The first three beds on each side, at the end next to the Imhoff tanks, are covered with a Lord & Burnham Co. Master Construction Glass-Over, 67 ft. wide and about 200 ft. long.

Full particulars and illustrations of other important installations gladly sent.

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When writing, please mention PUBLIC WORKS

Inspection of Michigan Highway Water Supplies

Opening the eighth year of its program for insuring safe drinking water for highway travelers, the Bureau of Engineering of the Michigan Department of Health began the 1932 inspection of roadside water sources the latter part of May.

The work this summer will be conducted as in previous seasons. Samples of water will be collected from sources likely to attract passing motorists, and sent to the laboratories of the state health department for analysis, and the supplies found to be safe will be posted with the yellow metal approval sign reading, "This water safe for drinking—Michigan Department of Health." The survey will include trunk line roads and a few of the more heavily traveled county roads.

During the seven-year period in which this program has been in operation, the percentage of safe sources of drinking water along highways has increased from 63.7 per cent in 1925 to 81.6 per cent in 1931. The inspection in 1931 entailed traveling 7,200 miles, collecting samples from approximately 2,000 sources, and analyzing some 2,100 samples.

Tourists and other highway travelers are cautioned against drinking water from supplies other than those marked with the approval sign of the Department of Health. Particular emphasis is placed on the danger of relying on the safety of spring water, for results of the roadside water survey disprove the traditional belief in the purity of springs, more than two-thirds of the springs inspected having been analyzed as unsafe.

Cotton Guard Rope in Swimming Pools as a Source of the Colon-aerogenes Group

The source of positive presumptive tests on the new indoor pool of the University of Rochester which contained the prescribed residual amount of chlorine (0.2-0.5 p.p.m.) was traced to a cotton guard rope, it was stated in a paper by H. W. Leaky presented at the annual meeting of the New York State Association of Public Health Laboratories. The cultures isolated from the rope gave the typical cultural reactions of *Aerobacter aerogenes.* On removing the rope from the pool the presumptive tests became negative. It is concluded that guard ropes made of organic material are unsuitable for use in swimming pools. Such ropes provide crevices containing organic material in which bacteria of the Colon-Aerogenes group, protected against the killing action of the chlorine, can multiply.

Plankton Nuisance

In the spring for the past three or four years, complaints have been received of odor nuisances in the coves along the Marin County shore of San Francisco Bay. An investigation made last year shows that it was due to the presence of a microscopic alga. Its return has been watched for this spring and about the middle of May the growth began to appear until at the present time it is so thick that it rolls up as a thick sludge in nearly all of the coves. There are thousands of tons of this growth. As it begins to die it gives off hydrogen sulphide and heavy odors of

protein decomposition. For the growth of this alga, the requirements are much silica and slight sewage pollution, sunshine and warm weather. It is possible that it may be growing widely in the San Francisco Bay and only because winds blow it to the Marin shores does it become troublesome there. It constitutes an odor nuisance only.—California Health Bulletin.

Sewerage Work Under Depression Conditions

In our English contemporary, "The Surveyor," a leading engineer, H. C. H. Shenton, discusses the construction of water supply and sewerage work in times of depression. Says he:

"There are many places, especially in rural districts, where it is quite impossible for the inhabitants to provide the money which is required in order to carry out [water supply and sewerage] work which is urgently necessary. When added to this one considers the difficulties consequent upon a financial crisis, such as that which has occurred, it becomes very clear that if we are to avoid falling back to the insanitary conditions of the past, and if, in short, we are to preserve the life and health of an important section of the community, some reconsideration of methods, if only for temporary application, is desirable."

As in many states in this country, such works can be constructed in England only with the approval of a government agency, and "it is naturally impossible to obtain the sanction of the Ministry of Health for any loan unless it is absolutely certain that the work is well designed and is to be carried out in such a manner that there can be no doubt as to its fulfilling all requirements; no risk can be taken such as a private owner might be prepared to accept, no experiments may be made with public money, and all legal formalities and requirements, whether sensible or not, must be fulfilled. Thus, although it might in a particular case be possible to save a great deal of money upon sewage-disposal works, following the dictates of common sense, a poverty-stricken local authority may be forced to construct works of an elaborate and expensive character. If they cannot afford to do so, the whole scheme of drainage is indefinitely postponed, and very insanitary conditions have to remain unchanged."

Mr. Shenton then refers to the conclusion of the Royal Commission on Sewage Disposal that "crude sewage could be allowed to discharge into rivers, provided the volume of the river were sufficient to insure an adequate dilution of the sewage"; which conclusion has not been accepted by the Ministry of Health, but it has insisted (in the words of the late chief engineering inspector of the Ministry) on "needless expenditure in the carrying out of small sewage disposal works, which often cause more concentrated and serious pollution than would have resulted had the same volume of sewage been discharged in its crude state into the river at different points separated by sufficient intervals to ensure the necessary dilution.

"What the effect of the discharge of crude sewage into a river of a certain size may be can only be settled when the facts are at hand, but it is well known, and is confirmed by the highest evidence, that there has been a great deal of needless expenditure. Further, at a time when everyone is urging the necessity for economy, this needless expenditure of public money is enforced by law, and engineers are not allowed to use their common sense.

"It is certain that many local authorities cannot possibly afford to carry out works which are urgently required for the maintenance of health conditions, not because the ratepayers are unable to do anything, but because they cannot find enough money to carry out work of the particular type and standard and completeness that is generally approved.

"It is not suggested that any work of an inferior character should be approved or carried out, but that permission should be given for the omission of certain parts of the work which are not as absolutely essential as that which is carried out."

Studies in Fumigation

Recent studies of the U. S. Public Health Service relating to the fumigation of vessels have revealed some interesting facts. It has been proven beyond the possibility of a doubt that the mere release of a fumigant in an enclosed space does not result in a penetration of the gas in lethal concentration in all retired locations and closed air spaces.

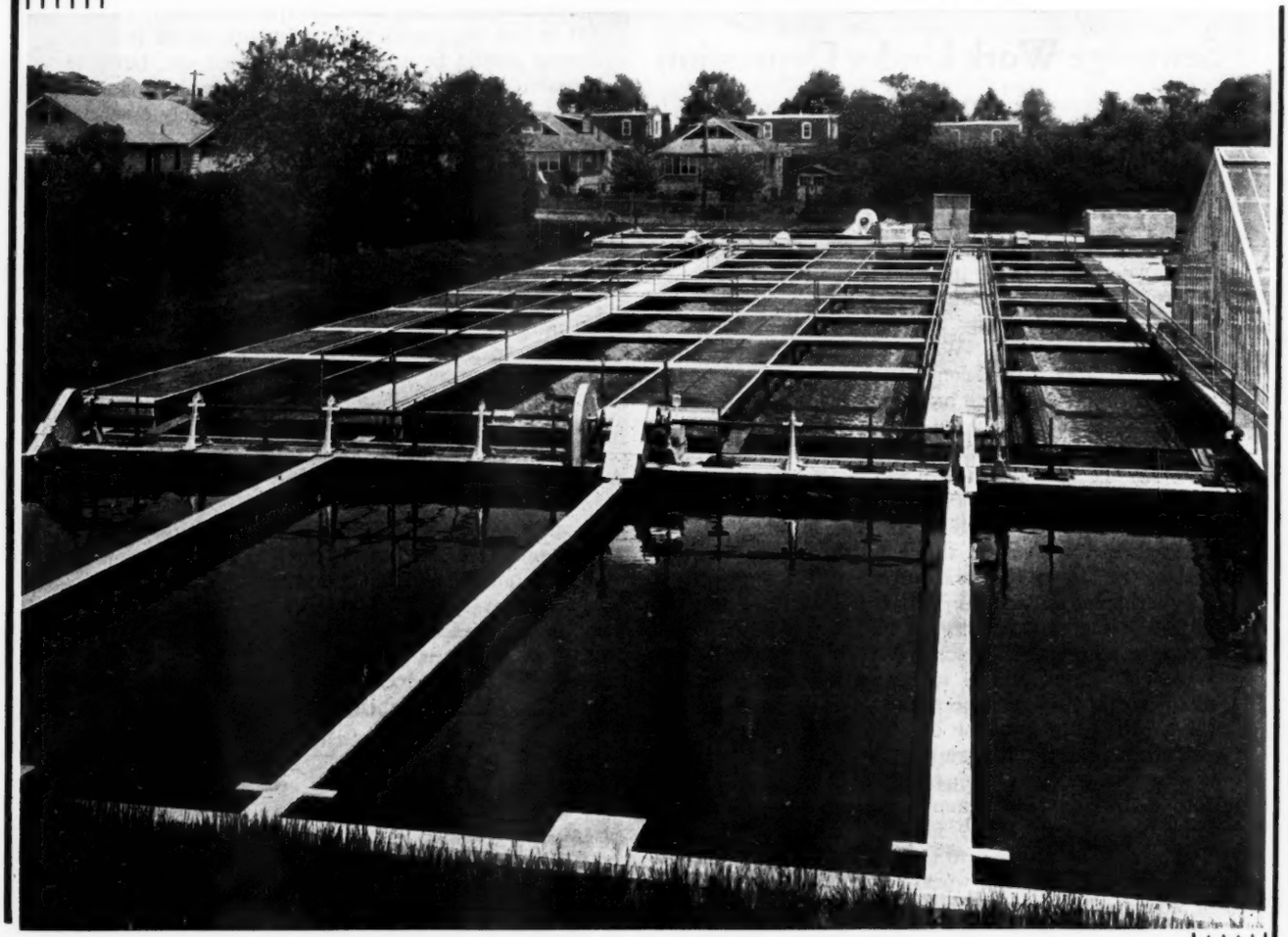
Since the penetration of fumigant gases in the short exposure periods necessarily used in ship fumigation is probably dependent far more on internal air currents than on gaseous diffusion, it is apparent that to secure sufficient penetration, reasonably wide avenues for air currents must be provided. Natural penetration, however, now is not essential; instead, the gas may be injected directly into rat harborages. To do this, of course, it is first necessary to know where the rat harborages are located and only preliminary inspection can disclose them.

Young rats exhibit a distinct tendency to burrow into the material of which nests are constructed, and so may escape the fumigating gas. Not infrequently new nests are built over old ones so that there may be a considerable collection of litter under them. Sometimes nests are deeply placed in collections of boatswains' stores, particularly oakum, old rope or similar material.

The possibility of foodstuffs absorbing the fumigating gases is always a matter of interest. With the cooperation of a large tea importing company, a number of samples of tea were fumigated for two hours with liquid hydrocyanic acid gas containing 10 per cent chloropicrin, in concentrations from 2 to 8 ounces per 1,000 cubic feet. When these samples were tested by three tea experts on the following day they could not be distinguished from unfumigated samples.

It has been definitely determined that hydrocyanic acid gas in high concentrations interferes with the ripening processes of fresh fruits and causes delicate vegetables, such as lettuce, to wilt. This effect appears some days after the fumigation. In the concentration used to destroy rats on ships, however, no injurious effect has been noted. In one experiment conducted in cooperation with a large steamship company, a number of samples of various fruits and vegetables were fumigated with hydrocyanic acid gas and with sulphur (by burning) in the amounts used for ship fumigation. After fumigation and overnight airing, the samples were stored with similar unfumigated produce. Ten days later the hydrocyanic acid gas fumigated samples showed no deterioration, but those fumigated with sulphur were spotted or had turned dark, becoming a partial or total commercial loss.

Modernize Sewage Treatment Facilities a Step at a Time . . . . . .



Collingswood, N. J. (Remington, Vosbury & Goff, Consulting Engineers) activated sludge plant. Capacity 1.3 M.G.D. Population connected 13,500. Two primary settling tanks with Link-Belt Straightline collectors in background. Aeration tanks with Link-Belt Straightline aerators in center and four final settling tanks with Link-Belt Straightline collectors in foreground. The clearness of the effluent is indicated by the reflections in the tanks.

IT is not always necessary to replace an obsolete sewage treatment plant with an entire new one.

A start can be made towards mechanization and improvement of old structures, with a comparatively small expenditure.

The work can be done better with present-day automatic equipment—with low maintenance cost, improved sanitation, and less drudgery and filth.

It is possible to rebuild and improve an old plant by stages, or build a new plant a part at a time, with intelligent planning, in which each step makes an improvement in purification.

At Collingswood, N. J., old contact tanks were rebuilt into aeration tanks for the activated sludge plant.

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New England Water Works Association

The 51st annual convention of the New England Water Works Association will be held at Springfield, Mass., headquarters at Hotel Kimball, September 27-30. The tentative program is following the opening session Tuesday morning:

Tuesday, 2 P. M.—Description of the Springfield Water Works, E. E. Lockridge, Chief Engineer; The Cobble Mountain Dam, Harry H. Hatch, Division Engineer; The West Parish Filtration Plant, Herbert F. Salmond, Chemist; The Cobble Mountain Power Development, Herbert A. Moody, Hydraulic Engineer, Turner's Falls Power and Electric Company. In the evening there will be a reception and dance. Wednesday will be superintendents' day. The forenoon sessions will include general discussions upon meters, water main cleaning and water consumption, opened by following papers: Testing Meters at Hartford, Connecticut, W. A. Gentner, Office Engineer, Water Bureau, Hartford; Experiences with Water Main Cleaning, Arthur T. Clark, Chief Engineer, Greenwich Water Company, Greenwich, Connecticut; Water Consumption in American Cities, A. Prescott Folwell, Editor, Public Works, New York City.

In the afternoon there will be a general discussion on tastes and odors in water supplies, opened by following papers: Use of Activated Carbon in the Water Works Field, F. E. Stewart, Industrial Sales Company; Experiences with Chlorine-Ammonia Treatment. To be announced later: Aeration in Water Treatment, Herman B. Anderson, Vogt Bros. Mfg. Co., Louisville, Ky. A dinner dance will be held in the evening.

On Thursday there will be an excursion to the Springfield Water Works, followed by the smoker in the evening. The Friday morning session will include the following papers: The Recent Drought in New England and Its Effect on Water Supplies of Southern New England, Caleb M. Saville, Chief Engineer, Hartford Water Bureau.

10 A. M.—Manganese in Impounded Water Supplies, Robert Spurr Weston, Consulting Engineer, Boston.

11 A. M.—The Mechanical Conditioning of Treated Waters, R. S. Rankin, The Dorr Company, New York City. The afternoon will be left free for inspection trips to local points of interest.

North Dakota Water and Sewage Conference

The fourth annual meeting of this conference will be held at Minot, N. D., September 26-28. The officers of the association are: E. L. Lium, president; S. P. Ravnos, vice-president; A. L. Bavone, Bismarck, secretary-treasurer.

Personal News

Robert Newton Clark, formerly of the King Construction Co., No. Tonawanda, N. Y., has joined the staff of Innis, Speiden & Co., 117 Liberty St., N. Y., and will develop the uses and sales of "Iso-Ferric Chloride 66," a coagulant for sewage treatment.

Ralph D. Earle, Jr., formerly manager of the New York office of Incinerator Dept. of the Pittsburgh-Des Moines Steel Co., has joined the D-N Corporation and Decarie Incinerator Corporation, 155 E. 44th St., N. Y.

Clarence E. Bement has resigned his post as Vice-President and General Manager of the Novo Engine Company to become Chairman of the Board. He will be succeeded by Eric P. Teel, formerly General Superintendent of the Company.

George Paul Torrence has been elected president of Link-Belt Co., manufacturers of conveying and power transmitting machinery. Mr. Torrence, who was graduated from Purdue University in 1908, has been with Link-Belt Co. since 1911, and has risen through the various grades, becoming vice-president in 1928.

Frank R. Wheeler has been appointed special representative of the Worthington Pump and Machinery Corp., with headquarters in Chicago.

A Booklet on Hoover Dam.—Volume 2 of a series of booklets describing work at the Hoover Dam as it progresses has been issued by Ingersoll-Rand Company. The building of Boulder City and the driving of the four 56-foot tunnels which will divert the Colorado River through the walls of Black Canyon while the dam is being erected are featured in the current issue. These booklets appear under the general title, "The Story of the Hoover Dam" and are obtainable at the main office of the Company, 11 Broadway, New York, or at any branch office. Volume 2 consists of 40 pages and 85 illustrations.

Sullivan Equipment Catalog.—Sullivan Machinery Company, 400 No. Michigan Avenue, Chicago, has just issued a new loose leaf catalog of its equipment, parts and supplies, used in connection with hammer drills in mines, quarries and on construction work. Copies will be sent on request.

The Diesel Engine Manufacturers' Association announced today that at a recent meeting, H. Birchard Taylor of Philadelphia was elected President, succeeding George W. Codrington of the Winton Engine Company of Cleveland, who was elected Chairman of the Board. E. T. Fishwick of the Worthington Pump and Machinery Corporation continues as Chairman of the Executive Committee.

The contract for furnishing, installing and operating all necessary sewage pumping equipment for the duration of A Century of Progress Chicago's 1933 World's Fair, has been awarded to Yeomans Brothers Company, Chicago. The contract comprises four underground automatic electric pumping stations, each containing three direct connected non-clogging vertical shaft units varying in capacity from 1300 to 5700 G.P.M.

The Austin-Western Road Machinery Co., domestic sales organization of The Austin Manufacturing Co. and The Western Wheeled Scraper Co., announce that they will handle the industrial sales and service of Cletrac Crawler Tractors in 24 states, broadly the territory covered by the Midwestern, Southern and Southeastern states. This new arrangement of combining the sales of these prominent equipment manufacturers provides from one source a complete sales and service on a broad line of haulage, construction and road maintenance machines, including tractors, graders, elevating graders, fresnos, scrapers, planers, rollers, motor graders, motor sweepers, crushing and screening plants, crawler cranes and shovels, and a wide variety of accessory equipment.

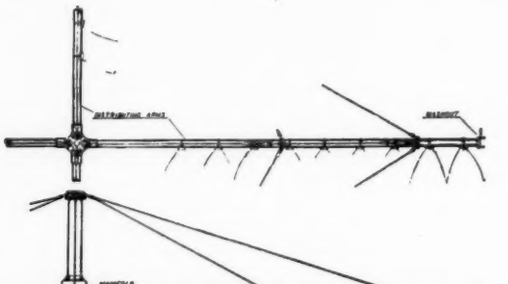
The present Cletrac organization continues to handle nation wide agricultural sales, and industrial sales and service in all other territories.

A fleet of 100 trucks equipped with 1½ yard, all steel, braced, side rub rail, tubeless hydraulic hoist dump bodies made by Hercules Products Co. These were recently delivered to the Pennsylvania Highway Department.

Developments in Water and Sewerage Equipment

The Dorrco Distributor

A new, self-propelled, revolving distributor, operating without outside-power and requiring hydraulic heads as low as 12 inches, is being introduced by The Dorr Company, Inc. under the name of the Dorrco Distributor, for applying settled sewage evenly over circular, trickling filter beds. The distinctive feature of the Dorrco Distributor is the adjustable, flat spray nozzle. From it the sewage issues as a thin, transparent sheet, fan-like in shape. Due to their staggered positions on the rotating distributing arms, the sprays wet overlapping areas, assuring the complete utilization of the surface of the bed at each revolution. The total absence of dry spots on the bed surface also effectively prevents the breeding of flies, as these cannot thrive on a continuously-wetted surface. The nozzles are readily adjusted in the field, both as to volume of sewage passed and as to the shape and thickness of the spray.



The Dorrco Distributor

In the Dorrco Distributor clogging is minimized by using a few large milled slots in place of a larger number of small holes and by leaving both ends of the nozzle lip open so that the simple sweep of a stick or screw driver will remove any obstruction which happens to lodge between the nozzle casting and its flexible and adjustable lip.

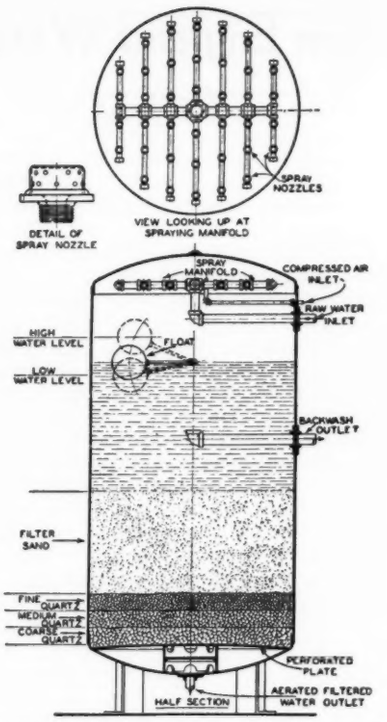
The Dorrco Distributor may be built in a wide range of sizes, the largest designed to date having a diameter of 180 feet and capable of serving a contributing population of about 11,000 persons.

It may be fed either from an automatic dosing siphon or may be fed directly by a pump. In either case satisfactory operation may be secured with a head of 12″ of water and the reaction of the sprays provides all of the tangential force required to rotate the arms. It can be operated in cold climates without interruptions of service due to freezing. A special, low-level, drain spray is employed in such cases so that the entire distributor may be completely drained at the termination of each individual application of sewage.

The city of Escanaba, Mich., is operating a 150 ft. dia. Dorrco Distributor, the city of Signal Hill, Calif., a 90 ft. dia. unit and a 40 ft. dia. distributor is now being built for the city of Verona, Wisconsin.

Aerating Filter for Iron Removal

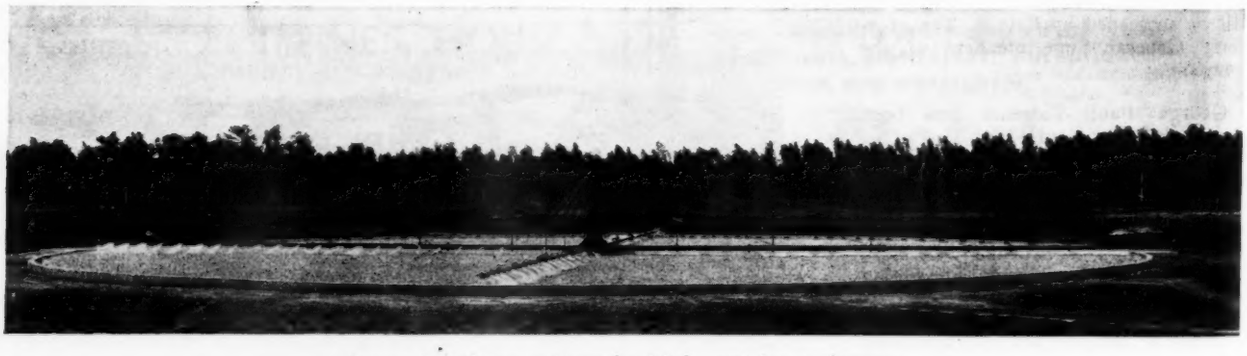
Removal of iron and odors from water by pressure aeration and filtering is accomplished by a filter now being built by the Elgin Softener Corporation, Elgin, Illinois. The water is pumped directly into a pressure filter tank, the top portion of which is filled with compressed air. As the water sprays through the compressed air it absorbs oxygen to oxidize the ferrous iron to the ferric state. The water then falls into the central section of the tank which acts as a retention chamber. During the passage of the water through this retention chamber, coagulation takes place so that by the time the water reaches the sand surface in the lower part of the tank, the iron is effectively removed by the filter sand. The water is filtered at a rate of 3 gallons per minute per square foot of sand area and the filtered water rarely exceds 0.1 part per million of iron.



Section of Elgin aerator and iron removal filter

From the sectional view of the filter shown, it will be noticed that the raw water enters the filter through a pipe which connects with the spraying manifold. This pipe manifold is fitted with spray nozzles. Compressed air is supplied by means of a small motor-driven compressor. The pressure in the filter is normally maintained at about a range of 30 lb. to 60 lb. per sq. in., and this pressure is controlled automatically by means of a float.

Filters of this type are also built in conjunction with the zeolite type of water softener. In this case, the iron removal filter surrounds the tank containing the zeolite water treatment. The iron is first removed from the water and then this filtered water supply passes through the softener to eliminate the hardness. It is also possible to operate the iron removal filter in conjunction with any type of water softener.

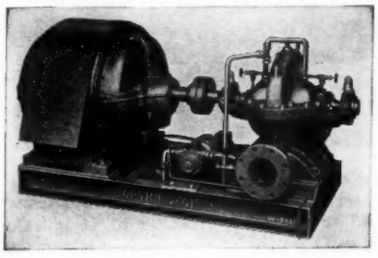


Dorrco Distributor at Escanaba, Mich., 150 feet in diameter

Recent New Construction Equipment

Automatically Primed Centrifugal Pump

Announcement has been made by Worthington Pump and Machinery Corporation of a new self-contained automatically primed centrifugal pumping unit, having many distinct advantages. It comprises an electrically-driven high efficiency ball bearing cen-



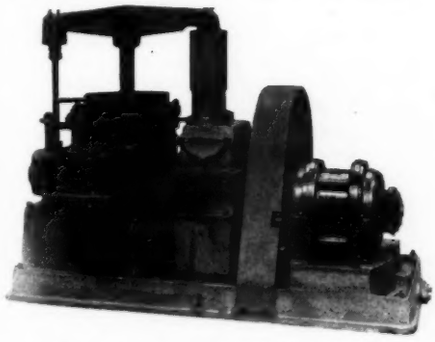
New Worthington Pump

trifugal pump with a Monobloc priming unit of the wet vacuum type, controlled by an electric pressure switch. The priming pump, or evacuator, is an adaption of the well-known "Hytor" pump, and is licensed to Worthington under patents of the Nash Engineering Company.

The evacuator is connected to the "high spot" of the suction volute by means of substantial tubing, and is sealed with clear water held in a reservoir built into the bedplate of the complete unit.

New Domestic Sludge Pump

The Domestic Engine & Pump Company, Shippensburg, Penna., have recently developed a new sludge pump in both single and double plunger types, which can be furnished with either plunger or diaphragms. Illustration



The New Domestic Sludge Pump

shows the single plunger pump with electric motor drive.

The Diaphragm pump is used where the heads are low and the Plunger Pump where the service is more severe.

The Pump may be furnished for a constant speed and capacity or with variable speed transmission so that any intermediate capacity from minimum to 5½ times minimum may be obtained. Capacities of the single pump range up to 5,000 gallons per hour and of the double pump up to 10,000 gallons per hour.

Telsmith Cone Crusher

Smith Engineering Works, Milwaukee, Wisc., manufacture the Telsmith cone crusher, in which, it is stated, fine aggregate does not pack at the bottom of the head. The spring-pressed concave checks packing and eliminates the danger of breakage by tramp iron. The conical head gyrates so rapidly that every piece of rock is pinched several times during the progress through the crusher. The gyration of the head is longest at the bottom, diminishing to a slight movement at the point of feed. The projecting "knob" agitates the rock supply and prevents bridging of the larger slabs in the steel receiving hopper. The reduced stroke at the top of the concave, the point of feed, prevents over-feeding and allows a free gravity flow of rock into the bowl. Very little oversize reaches the discharge opening.

New Line of Hydraulic Jacks

A complete line of hydraulic jacks, 23 models ranging from 1½ to 30 tons capacity, is now being made by the Hein-Werner Motor Parts Corporation, 1222 National Ave., Waukesha, Wisconsin. These are priced midway between most hydraulic and mechanical jacks. Some of the outstanding improvements, are (1) Pinnacle lift . . . a lift greater in proportion to height than that of any other single ram hydraulic jack; (2) Bi-power Safety . . . every jack designed to withstand twice its rated capacity (primarily a safety measure); (3) Leak-proof housing . . . a positive elimination of all sweating or seepage of oil. The complete line includes models designed for passenger cars, light delivery trucks, heavy duty trucks, coaches, buses, tractors, agricultural machinery and all industrial purposes. Catalogs and prices will be sent on request.

A Quick Starter for Cold Weather

The Sullivan "Start-O" heater is a device for supplying heat to an internal combustion engine to make outdoor starting easy in cold weather. The heat thus furnished warms the combustion chamber and the intake manifold from the carburetor, as well as the moving parts, so that the engine can be started in winter almost as quickly as in midsummer. Thus winter jobs are not held up and men and equipment kept waiting because of delay in starting gasoline engines in the morning.

Although intended primarily for use on Sullivan compressors, this device may be adapted for use on any make of portable compressor; or on any type of gasoline-engine driven equipment, by a few alterations, easily made in the field.

Harnischfeger 2-Yard Dragline

The Harnischfeger Corp., Milwaukee, Wisc., has introduced a new 2-yard high speed dragline, known as the Model 780. This machine has a hoist line speed of 180 feet a minute, a dragline speed of 150 feet a minute and a

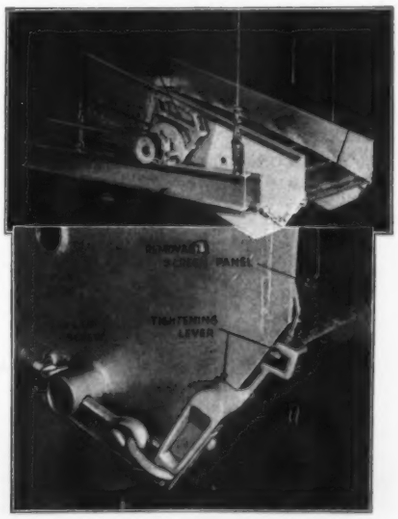
Harnischfeger 780 Dragline

rotating speed of 3 rpm. It carries a 60-foot boom and a 2-yard bucket. It is powered with either gasoline or diesel engines. While this dragline weighs 70 tons, it has a ground pressure of only 10.75 pounds per square inch, and possesses a high degree of mobility.

Custom Built Vibrator Screen

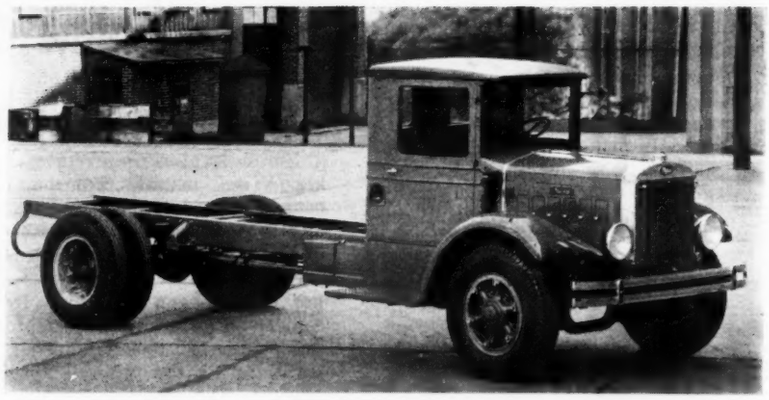
In announcing a new Vibrator Screen, Stephens-Adamson Mfg. Co. of Aurora, Illinois, emphasize the fact that each screen is built with a vibrating unit assembled to suit the material handled.

The screen is of the positive vibration type, in which a rigid screen body with one or more decks is given a vibration of fixed amplitude by the rapid "throw" of an eccentric shaft. There are three units—screen body, vibrating mechanism and subframe.



Upper—New S-A Vibrator Screen is mounted by means of four cables. Lower —Improved method of stretching the quick-change screen panels.

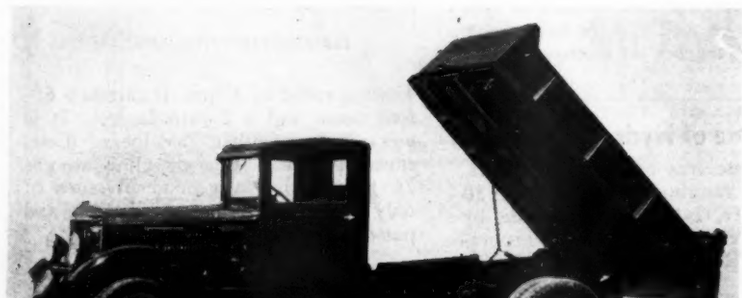
Many Improvements in New Truck Models



Mack Trucks, Inc., New York, has brought out three new 6-cylinder trucks, covering medium and heavy duty high speed service. The external appearance is well illustrated by the photograph above. Road speeds range from 29 to 41 miles an hour with standard gearing, and up to 57 miles on the over-gearing. On the BM, 93 horsepower is produced at 2250 rpm; on the BX, 104 hp. at 2300 rpm; and on the BQ, 127 hp. at 2050 rpm.

Reo Adds 8-Cylinder, 4-Ton Truck

Reo Motor Car Co., Lansing, Mich., has announced a new 8-cylinder, 4-ton truck. This new truck has a Reo ability rating of 20,000 - 3¼ - 43, which means it will handle a load of 10 tons gross, over a 3¼% grade in first drive and will travel over average hard level roads at 43 miles an hour with the engine turning at 2800 rpm. The engine develops 110 hp. and has a piston displacement of 358 cubic inches. It is equipped with Electro-Vac governor, which will open and close within 0.5 mile an hour of the governed speed. The transmission provides 4 speeds.



Reo 8-cylinder 4-ton truck with Wood Hoist

Autocar 1½-ton Truck

The Autocar Company, Ardmore, Pa., announces their Model R 1½-ton Autocar, a 6-cylinder dual-rear-wheel truck with standard wheelbases of 159, 171, and 189 inches and a gross weight of 14,000 pounds. This is an unusually powerful and exceedingly well designed truck adapted to a wide range of hard service.

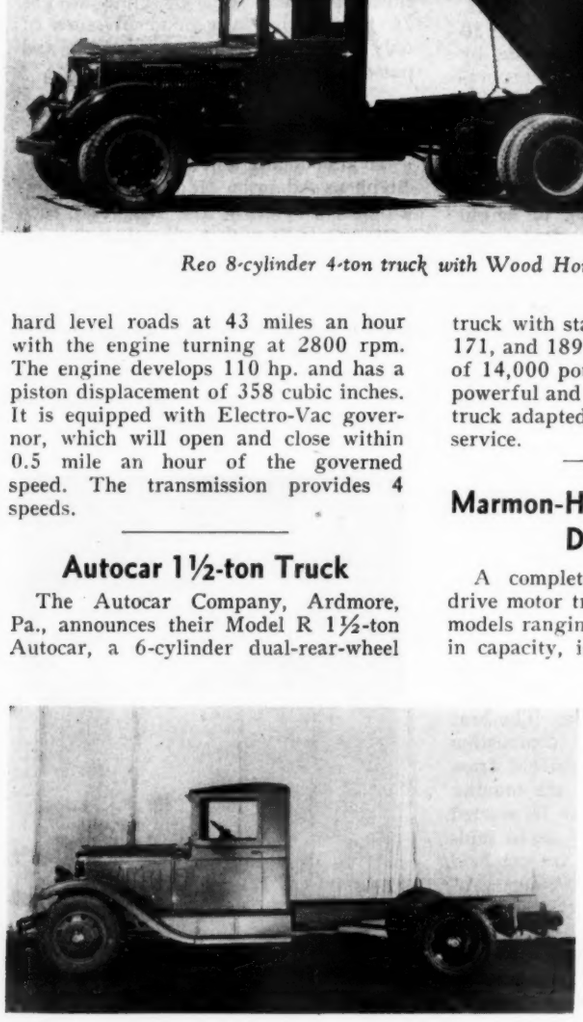
Marmon-Herrington All-Wheel Drive Trucks

A complete new line of all-wheel drive motor trucks, consisting of twelve models ranging from two to fifteen tons in capacity, is announced by the Marmon-Herrington Company, Inc., of Indianapolis.

This new line supplants the former offering of five models. Seven new models have been added, while the additional five have been improved and refined to make for greater efficiency in performing the tasks for which they are designed. Prices range from $3,785 to $17,500, f. o. b. factory, the lowest priced truck being the model TL-27-4 with a capacity of two to two and one-half tons, and the highest priced the model TH-330-6, a six-wheel-drive unit with a capacity of twelve to fifteen tons.

The new line is engineered and built to do the most difficult heavy jobs and at the same time perform with surprising agility and speed on the highway. A. W. Herrington, formerly consultant of the U. S. Army, and president of the company, is the designer of the new line.

Outstanding features of the new line include the exclusive and patented front axle and front steering arrangement design; the equipping of all trucks with both standard and auxiliary transmissions giving as many as twelve speeds forward and four reverse; the application of power to secure the maximum advantages of all-wheel drive traction; and an ease of handling and control that can be compared only with the finest passenger cars.



The new Autocar 1½-ton truck with 6-cylinder engine is adapted to a wide variety of service

Marmon-Herrington 5-7 ton truck

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★ *It is a good practice to check this list regularly because descriptions of new bulletins are always being added.*

Construction Materials and Equipment

Accessories for Motor Trucks

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

9. Illustrated manual No. 11 describes "Hotstuff," the master oil burning heater. The only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Plants

10. Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate. J. D. Farasey Mfg. Company ,Cleveland, Ohio.

Asphalt Rollers

12. How to use Rollers to Save Tamping Costs. 16-page booklet gives details and also specifications of the Erie Roller. Issued by the Erie Machine Shops, Erie, Pa.

Bins and Hoppers

20. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Material Handling Buckets, showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Material Handling Buckets will also be furnished on request.

Clamshell Buckets

27. Clamshell Buckets, showing the various types, sizes and uses for which they are intended, and construction features and other valuable bucket information. A complete catalog on all types of Clamshell Buckets will also be furnished on request. The Owen Bucket Company, Cleveland, Ohio.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subjects suggested by title.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Solvay Sales Corp., 61 Broadway, N. Y. C.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Bridges, Culverts and Concrete Products." It includes reports from the Highway Research Board, the Bureau of Public Roads and State Highway Departments. Columbia Products Co., Barberton, Ohio.

Concrete Mixer

44. Concrete Mixers, both Tilting and Non-Tilting types, from 3½s to 84s size, The Jaeger Machine Company, Columbus, Ohio.

Crushers

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg. Co., E. Jeffry, Mfg. Co., Columbus, Ohio.

Explosives

74. "Use of Explosives for Settling Highway Fills." A new booklet which fully explains by diagrams and charts the three methods developed after many tests by the Du Pont engineers, which singly or in combination will quickly and efficiently do your job. Just issued by E. I. Du Pont de Nemours & Co., Inc., Explosives Dept., Wilmington, Del.

Graders

76. Latest information about Galion Motor Patrol Graders, Road Maintainers and Leaning Wheel Graders is contained in a new series of illustrated catalogs, Nos. 125, 130, 135 just issued by the Galion Iron Works & Mfg. Co., c-o The Jeffrey Mfg. Co., Columbus, Ohio.

77. "Blade Graders" is a 48 page booklet, recently published by the Caterpillar Tractor Co., Peoria, Ill., giving the complete details of "Caterpillar" graders.

78. The No. 101 Austin Leaning Wheel Grader is completely detailed and illustrated in Bulletin No. 1238 which shows operation of Z-Bar, back sopper, bank cutter, etc. Published by The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

79. Austin No. 77 Dual Drive Motor Graders are completely illustrated and described in Bulletin No. 1239 which also contains construction details, specifications and weights. Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Joint Filler and Line Marker

88. Bulletin No. G-9 issued by Littleford Bros., 452 E. Pearl St. Cincinnati, Ohio, describes and illustrates their new No. 91 Joint Filler which is used to fill horizontal and center joints with hot asphalt. It can be equipped to apply an asphaltic center line as it fills the center joint. This bulletin also describes the Littleford Traffic Line Marker.

Joint Filling Pot

89. A supplement to Bulletin No. E-5 has been issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describing their cone-shaped crack filling pot No. 86-B. The chief feature of this pot is that it is springless—there is no mechanism to get out of order. It is used to fill cracks and joints in concrete pavements and interstices in brick or granite block pavements.

Lanterns and Torches

90. Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the higt ways. R. E. Dietz Co., 60 Laight St., New York, N. Y.

Loaders and Unloaders

97. Portable Loaders and Unloaders. Folders: Nos. 1248, 1298 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket elevators for different classes of work; and No. 1256, the "Grizzly" Crawler Loader for heavy work and large capacities. Link-Belt Company, Philadelphia

100. Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery. Link-Belt Co., Chicago, Ill. General Catalog No. 500.

Motor Trucks

105. A new line of heavy duty motor trucks and tractors for dump and commercial hauling is described in literature recently issued by the Sterling Motor Truck Co., Milwaukee, Wis.

106. "Trucks for Public Utilities," is a new illustrated booklet just issued by the International Harvester Co., 606 So. Michigan Ave., Chicago. Covers uses, types, special equipment, bodies and specifications. Sent free on request.

108. Four-wheel-drive trucks increase the range of truck operation and are particularly adapted for economy of operation in road building and maintenance. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

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9-32

Paving Materials

109. A 36-page booklet with 66 illustrations has just been issued by the Barrett Co., giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. 24 pages. The Barrett Company, 40 Rector Street, New York.

112. Complete directions for surface Cut Back Asphalt are contained in a 36 treatment and bituminous surfacing with page data book. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

Road Construction

122. "Road Building Machines" is a handy reference booklet to the complete line of "Caterpillar" road machinery. 40 pages.

Road Machinery

125. The following publications cover a wide range of valuable and useful information on road-building machinery. Sixty Leaning Wheel Grader, the Super-Special Grader, the Motor Patrols, the Twenty-Planer, the Hi-Way Patrol Grader No. 3, the Ten Motor Patrol, and the Auto Patrol. Caterpillar Tractor Co., Peoria, Ill.

126. A new picture book of the Austin-Western Line of road machinery showing the application of road graders, road rollers, elevating graders, crawler and wheeled wagons, crushing and screening plants, shovels, cranes and excavators, scarifiers and many small tools, is contained in Catalog No. 1247. Copies available on request at The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago.

127. "Road Machinery Illustrated." New illustrated bulletins on the motor rollers, three-wheel and tandem rollers, motor graders powered by Caterpillar, Twin City, Cletrac. McCormick-Deering and Fordson tractors, and straight and leaning wheel graders. Galion Iron Works & Mfg. Co., Galion, O.

Elevating Graders

129. An interesting booklet on Elevating Graders has recently been issued by the Caterpillar Tractor Co., Peoria, Ill.

Rollers

131. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Erie Machine Shops, Erie, Pa.

132. A 32-page book in four colors featuring a complete line of road rollers. 8¾ x 11, leatherette cover, numerous action pictures. Buffalo-Springfield Roller Co. of Springfield, Ohio.

133. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers and their uses. The Buffalo-Springfield Roller Company, Springfield, Ohio.

134. "Road Rollers." Illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Galion Iron Works and Manufacturing Co., Galion, O.

135. 36-page, illustrated book describing the application of Motor Rollers to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

Sand and Gravel Buckets

137. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Sand and Gravel Buckets showing the various types, sizes and uses for which they are intended. A complete catalog on all types of Sand and Gravel Buckets will also be furnished on request.

Sand and Gravel Washing Plants

140. Seventy-page catalog giving complete information regarding Sand and Gravel Washing Plants, stationary and portable. Those interested in such equipment should have a copy. Link-Belt Co., Chicago, Ill.

Shovels, Cranes and Excavators

144. Complete information including operating ranges of General Excavators is given in Bulletin No. 3105 recently prepared by The General Excavator Co., 365 Rose St., Marion, Ohio.

145. The Austin Badger, a new, fully convertible ¾ yard crawler shovel, made by The Austin-Western Road Machinery Co., 400 North Michigan Ave., Chicago, is fully described and illustrated in their Bulletin No. 1236.

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines.

Steel Posts

160. Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport Pa.

Surveying Instruments

164. Booklet on the most popular types of Transits and Levels in general use by Engineers and Surveyors, giving full information on the sizes and styles of these instruments. Issued by C. L. Berger and Sons, Inc., 37 Williams St., Boston 19, Mass.

Tires, Truck and Tractor

165. Speed and economy in use of solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

Tool Boxes

167. Bulletin No. G-6 issued by Littleford Bros. 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates the Han-DeeBox, a portable tool box of all-steel construction. This tool box is equipped with a special locking device that locks both covers at the same time. No padlocks are used. Littleford trailers, lead melting furnaces, and "Hot Dope" Kettles for pipe coating are also described in this bulletin.

Tractors, Crawler

171. The design, construction, details and complete specifications of the Ten and Fifteen models "Caterpillar" are given in a booklet published by the Caterpillar Tractor Co., Peoria, Ill.

172. The Caterpillar Sixty Tractor. This beautifully illustrated booklet tells the story of the Caterpillar Sixty Tractor design and construction. Caterpillar Tractor Co., Peoria, Ill.

175. Caterpillar Tractors. The "Fifty;" the "Thirty-five;" the "Twenty-five." Full data on these models. Caterpillar Tractor Co. Peoria, Ill.

Road and Street Maintenance

Asphalt Heaters

200. For general construction and maintenance, the Original Improved "Hotstuf" Asphalt Heater, an economical oil burning heater. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

212. "Wyandotte Calcium Chloride Prevents Dust the Natural Way,"—a publication, fully illustrated, treating on Dust Control, economical road maintenance and methods of application, issued by the Michigan Alkali Company, 10 E. 40th St., New York City.

Dust Laying

213. Full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer,"' 24 pages, 5½x8, covers application, economies, etc. Sent without cost. Solvay Sales Corporation, New York.

Emulsion Sprayers

214.—A complete line of emulsion sprayers is described in Bulletin No. G-5 recently issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio. Littleford Emulsion Sprayers will spray any type of asphalt emulsion used for penetration patch work or curing concrete. They are also used to spray silicate of soda and weed exterminators.

Highway Maintenance

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

216. "Light and Heavy Road Maintenance" describes fully the FWD truck and its economy for use in pulling road graders and maintainers—issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

218. "Maintenance Machines," a 32 page booklet, tells of "Caterpillar's" complete line of maintenance machines—3 sizes of motor patrols, a trailer patrol and planer—including machines to fit all pocketbooks and all road maintenance conditions. Caterpillar Tractor Co., Peoria, Ill.

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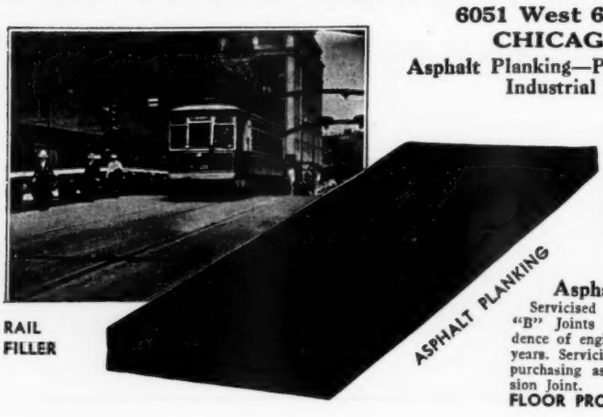

Servicised Fibrated Asphalt Plank is giving service in hundreds of first class installations. The pioneer of this line Servicised Planking has the unqualified approval of all who have used it. Write for prices today!

Servicised Asphalt Expansion Joint

Servicised Felt Sided and Type "B" Joints have enjoyed the confidence of engineers and contractors for years. Servicised service excels. When purchasing ask for Servicised Expansion Joint.

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Servicised Super Rubber Joint

This sponge rubber product excels in all tests in ageing qualities and resiliency, insuring greater life. Servicised Super Rubber Joint is particularly adapted for sidewalk, curb and gutter, building work, viaducts as well as pavement. The upkeep is reduced to a minimum. Write for prices today!

Servicised Fiber Cushion Joint

Formed of wood or vegetable fiber into a boardlike structure saturated with waterproofing material—a resiliently compressible and re-expanding product.

Maintenance and Construction Equipment

The Cleaver No. 2 Pumping Booster raises the temperature of a 10,000 gallon tank car of bituminous road material approximately 50° per hour, with a fuel cost of about $2.60. A 3-way valve allows material to be pumped back into the car between loads.

Speeder Road Broom

The Speeder Machinery Corporation, Cedar Rapids, Iowa, are now producing the Speeder Road Broom. This broom is a replacement unit 8 to 14 ft. wide for the cutting edge on any standard one man maintainer or pull type grader. The mold board and cutting edge are removed and the broom inserted instead.

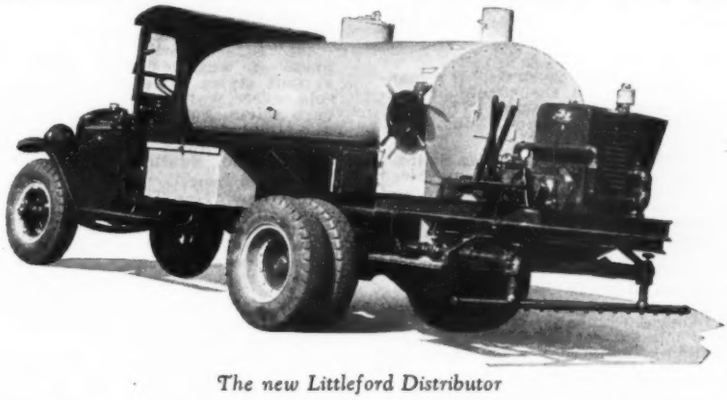
This broom is recommended particularly for gravel maintenance where the roads are subject to chatter and washboard bumps. The broom is composed of steel wires about 18 or 20 inches long which will give when striking some immovable object such as a deeply imbedded stone, thus eliminating the ridge that would be caused by a grader blade jumping over it. It also eliminates all the chatter and vibration of the ordinary maintainer equipped with a blade.

For oil mix work the broom gives a great deal more penetration than the ordinary grader blade because of the greater mixing ability of the broom, due to the springing action of the individual wires. Another advantage of the Road Broom is the fact that it does not become dull, as is the case with grader blades. No replacement of the broom is necessary until it is completely worn out. The life of a broom in most cases is estimated at about one complete season.

The broom is also built in a complete unit which it is not necessary to place on a grader chassis.

The New Littleford Pressure Distributor

A pressure distributor has been announced by Littleford Bros., 452 East Pearl Street, Cincinnati, Ohio. Standard sizes are available in 500, 600, 800, 1000, 1200 and 1500 gallon capacities and can be mounted on any suitable truck, trailer or semi-trailer, being adjustable to the chassis.

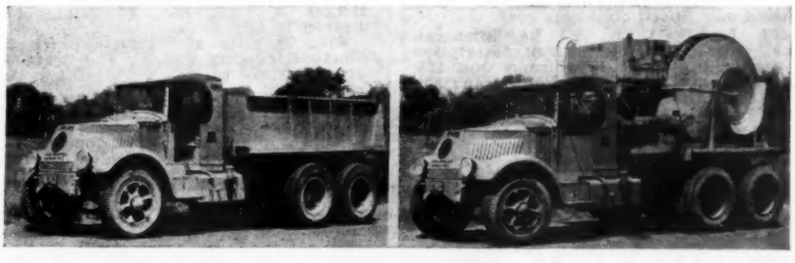


The new Littleford Distributor

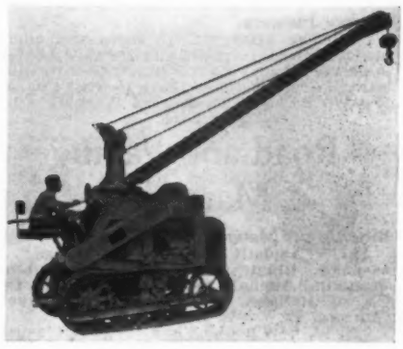
An important feature of the Littleford Distributor is Single Valve Control. The Littleford Six-Way Valve (Pat. Pend.) is controlled from a hand-wheel which is plainly marked "Fill," "Circulate," "Spray," and "Drain." At each point of operation, the hand-wheel sets so that operator knows positively that valve is in proper position. This hand-wheel is directly in front of the operator. Every operation is controlled from the operator's platform.

The Littleford Control Valve and Viking Pump will handle any kind of material whether tar, asphalt, road oil, cut-back, or emulsions. The distributor can also be used to spray liquid Calcium Chloride.

It is impossible in this space to give anything like a complete description of the outfit. Write to Littleford Bros. for a copy of their very complete catalog entitled, "The Littleford Pressure Distributor."



The eleven Mack Model AK, six-cylinder, six-wheelers, recently delivered to B. Perini & Sons, contractors of Framingham, Mass., are versatile units—dump trucks one day, concrete mixers the next. As earth movers they average 11 yards to the load. When concrete is ready to be poured, the dump bodies and hoists are easily removed and 5-yard Jaeger mixers mounted on the chassis. B. Perini & Sons is one of the oldest contracting firms in New England, having been in the business since the early days when wheelbarrows and tip carts were used.



The Bucyrus-Erie Loadmaster, which has a wide adaptability for useful work, is now powered by Caterpillar Equipment.

"Caterpillar" Announces Second Auto Patrol

A second Auto Patrol has been added to the "Caterpillar" line. This addition makes it necessary to identify the two models. The present model, therefore, will hereafter be termed Auto Patrol No. 9. The new model Auto Patrol No. 7. It weighs 10,600 pounds. It offers, at a remarkably low price, all of the performance features of the larger machine including three-lever power control, one for raising or lowering left end of blade, one for right end of blade, one available for either scarifier or snow plow attachment. It has the same frame members as the No. 9 and exactly the same engine and transmission. It has weight adequate for most maintenance work. It has traction correctly proportioned to its weight—dual 38" x 7" lug-type Road Builder pneumatic tires in the rear. Front tires are 32" x 6" truck-type. It has ample power.

Surface Heaters

225. The "Hotstuf" three in one, combination Tool, Asphalt and Surface heater is described and its use illustrated in Bulletin 16. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

Road and Paving Materials

Bituminous Materials

227. "Asphalt for Every Purpose," a 44-page illustrated booklet describing Stanolind Asphalt products. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

228. A new booklet has just been issued by The Barrett Co., 40 Rector St., New York, describing and illustrating the uses of each grade of Tarvia and Tarvialithic. 32 excellent illustrations.

229. A new series of concise and authoritative manuals of construction covering the latest developments in road-mix and surface treatment types as well as the standard asphalt pavements. These contain the best that has been developed by study, research and practical application in all types. Manual 1—Road-Mix Types is now ready for distribution. The Asphalt Institute, 801 Second Ave., New York, N. Y.

Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material, cost, method of laying, life, etc. National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. 47 pages. The Dow Chemical Company, Midland, Mich.

Gutters

240. "Brick gutters and Parking Strips." A study dealing with the problems faced in the proper construction of gutters and how they can be overcome. Covers design, construction and results. Well illustrated. Just issued by the National Paving Brick Ass'n., National Press Building, Washington, D. C.

Maintenance Materials and Methods

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

Snow Removal

Snow Fences

347. "Control Winter Drifts"—A new folder giving full details regarding use and construction of the Mattson snow fence has just been issued by the Mattson Wire & Mfg. Co., Joliet, Ill. Illustrated in two colors.

348. "Winter Maintenance" is the title of a booklet which illustrates many types of snow plows and methods of handling snow removal problems. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

349. "The Answer to the Snow Removal Problem." It gives full details of the Frink type S snow plow for trucks. Carl Frink, Mfr. of Clayton, N. Y.

354. "Snow Removal Equipment" pictures various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action. Caterpillar Tractor Co., Peoria, Ill.

359. Galion Iron Works and Mfg. Co., Galion, Ohio. Details, prices and catalogs of their snow plows adaptable to any make of truck.

Sanitary Engineering

Activated Carbon, Aqua NUCHAR

380. For low cost removal of tastes and odors from potable waters. Used by more than 300 municipalities. For literature address Industrial Chemical Sales Company, Inc., 230 Park Avenue, New York.

Glass-Overs

393. Full details regarding the use of Lord & Burnham Glass-Covers at Dayton, Ohio; Highland Park, Ill.; Fostoria, Ohio; and Bloomington, Ill. are given in bulletins Nos. 10, 11, 14, 15. Issued by Lord & Burnham, Graybar Bldg., New York, N. Y.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections. Atlas Mineral Products Company, Mertztown, Pennsylvania.

402. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

403. An illustrated folder has just been issued by the Cochrane Chemical Co., 432 Danforth St., Jersey City, N. J., detailing the advantages and the savings in the use of Ex-XL-cell Sewer Pipe Joint Compound.

Manhole Covers and Inlets

404. Street, sewer and water castings made of wear-resisting chilled iron in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

407. New "Handbook of deLavaud Centrifugally Cast Iron Pipe" contains useful information for the water works man including revised specifications together with dimensions and weights of deLavaud pipe in accordance with Federal Specifications for Pipe; Water, Cast-Iron (Bell and Spigot) N. WW-P-421. Just issued by the U. S. Pipe and Foundry Co., Burlington, N. J.

Pipe Line Construction

410. Pipe Lines and the Caterpillar. In this 32-page booklet are pictured many uses of the Caterpillar Tractor, and ways in which they can be applied to the saving of men, money and minutes. The Caterpillar Tractor Co., Peoria, Ill.

Pumping Engines

413. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Pumps, Centrifugal

415. Design data for centrifugal pumps for high or low service pumping for waterworks and filtration plants. Dayton-Dowd Co. Mfrs. Centrifugal Pumps, Quincy, Ill.

Pumps, Self-Priming

416. "Make your present pumps self-priming." Bulletin No. 530 B describing the Hazleton Suction Line Primer which can be applied to old as well as new pumps regardless of make. Issued by Barrett, Haentjens & Co., Hazleton, Pa.

Pumps—Sewage

417. Non-clog vertical and horizontal sewage pumps and their characteristics are described and illustrated in bulletins of the Dayton-Dowd Co., Quincy, Ill.

Screens, Sewage

418. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link Belt Company, 910 So. Michigan Ave., Chicago, Ill. Book 642.

Screens

420. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., Chicago, Ill.

Sludge Bed Glass Covers

426. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

427. Bulletin GE31 describes Glass Enclosures for Sludge Beds in detail. Specifications, cross sections, details and illustrations shown are of value to engineers and officials. Sent promptly upon request. American-Moninger Greenhouse Mfg. Corp., Dept. B, 1947 Flushing Ave., Brooklyn, N. Y.

Treatment

433. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link Belt Co., 910 So. Michigan Ave., Chicago, Ill. and Philadelphia.

Water Development

440. Complete details of the Layne System of water development for municipalities and irrigation projects, based on deep wells and turbine pumps. Layne & Bowler, Memphis, Tenn.

Miscellaneous

Airport Construction

595. Airports and Airways. A 20-page illustrated booklet by the Caterpillar Tractor Co., Peoria, Ill., describes the uses of tractors in building airports and handling planes.

597. "Getting on the Air Map With 'Caterpillar,'" describes the many uses of the tractor in building and maintaining airports better, quicker, cheaper. Caterpillar Traction Co., Peoria, Ill.

Chains and Speed Reducers

607. Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill., gives full description of its positive drives in books No. 125. Silent Chain; No. 1257, Roller Chain; No. 815, Herringbone Speed Reducers; No. 1050, Promal Chains. Send for these positive power transmission books.

Community Advertising

610. Booklet showing various forms of publicity matter useful in arousing interest in the construction of small town water supplies. This matter is furnished free to Consulting Engineers and towns interested in waterworks construction by The Cast Iron Pipe Research Association, 566 Peoples Gas Bldg., Chicago, Ill.

Transits and Levels

629. A booklet giving full information on the sizes and styles of Berger Transits and Levels will be sent promptly by C. L. Berger & Sons, Inc., 37 Williams St., Boston 19, Mass.

630. Transits and Levels particularly adapted for City, County and State work are described in a 64-page catalog. Warren-Knight Co. 136 No. 12th St. Philadelphia, Pa.

Wire Rope

634. Williamsport Wire Rope Co., Chicago, Ill., has issued a folder illustrating their new method of "preseating."

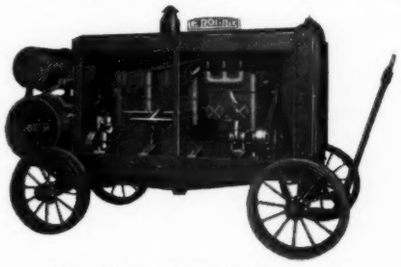
SWEET'S
STEEL POSTS
STRONG DURABLE POSTS
for every kind of Fence and Sign Post requirements —
SWEET'S STEEL COMPANY - WILLIAMSPORT, PENNA.

Le Roi Company Air Compressors

A complete line of portable and stationary Le Roi-Rix air compressors have been placed on the market by Le Roi Company of Milwaukee, Wisconsin. These machines are built with the patented Rix supercharger, which results in an unusually high efficiency.

Since the amount of actual delivered air, rather than the piston displacement, is the factor which determines the work any given machine will do, Le Roi Company not only state the actual air delivery of the Le Roi-Rix Compressors, but positively guarantee this air delivery.

Since Le Roi-Rix machines are built



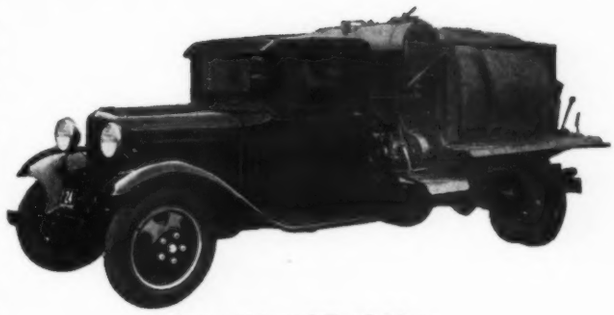
The New LeRoi-Rix Compressor

entirely by Le Roi Company, it has been possible to design the air compressor and engine to fit each other exactly, and the result is a machine of unusual quality and extreme compactness.

Giant-Gript Straight Edges

L. & M. Manufacturing Co., 10,300 Berea Road, Cleveland, O., has brought out a combined straight edge and scraper, which has many advantages. Not only does it gauge the riding surface of the concrete, but it may be used as a scraper for removing excess water and laitance from the concrete. It will not deform under hard usage. Enamel finish prevents wet concrete from sticking. The handle cannot become loose. It is painted a brilliant orange so that it can be seen at all times.

1932 Jaeger 1½-Yd. Truck Mixer



Jaeger 1½-yard Truck Mixer

A higher speed truck mixer for both the contractor and the commercial concrete plant is offered in the 1932 Jaeger 1 and 1½-cubic yard units mounted on the 1932 Ford chassis. The 1-yard unit is furnished for 132″ wheel base and is driven direct from the truck engine. The 1½-yard unit is furnished with separate engine drive for 157″ wheel base chassis.

With the greater speed of the new Ford, these truck mixer units are ideal for express service use by commercial concrete plants and for use by contractors on road widening and maintenance work, aprons, bridges, conduit, sewer, curb and gutter work.

A "Zero Pressure" Tire for Tractor Service

Following three years of experimental work, the B. F. Goodrich Co., Akron, O., has announced a new type of high traction tire known as the "Zero Pressure" perfected to meet the needs of tractor service. It is called "Zero Pressure" because it has cushioning qualities equal to or better than a pneumatic, yet has no air under pressure within the tire.

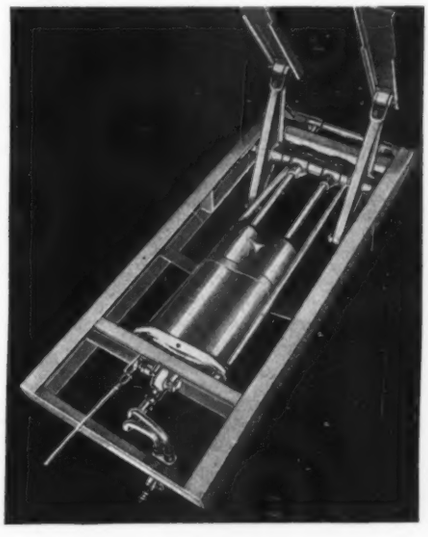
The tire is designed to provide a snow-shoe effect in loose or soft soil, or sand, having a tread which deflects readily under load and provides unusual tractive qualities. As the tire is not under air pressure, no penetrating obstacle can damage it or cause delay.

Bouncing is eliminated, the tire rides easily, will not damage pavements, requires no inflation, and allows the equipment to operate at a greater efficiency than has heretofore been possible with either Solid or Pneumatic tires. The tire has already been widely accepted on road construction machinery and in some types of agricultural work.

New Trenton Hydraulic Body Hoist

Fitz Gibbon & Crisp, Inc., of Trenton, N. J., announce a new hydraulic hoist with high angle lift and quick action; a complete, self-contained, compact unit. The load is evenly distributed over a large chassis area. Maximum hydraulic pressures are low. Valves in cylinder head, and other novel features, contribute to trouble-free operation; guaranteed for two years.

This hoist is built in two single cylinder and two twin cylinder models to cover all load and dumping conditions. All models are complete units, including: cylinders, pump, lifting arms, hinges, pump-drive, power take-off with control, clamps and wood sills. Mounting requires no drilling of holes nor other fitting, it being merely necessary to clamp the hoist unit on the chassis.



At left, Giant-Gript Straight-Edge. Center, Goodrich Zero Pressure Tire. Right, Trenton Hydraulic Hoist.

Official Advertising

STATE DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at the State Office Building, 13th Floor, Albany, N. Y., until one o'clock p. m., advanced standard time which is twelve o'clock noon eastern standard time, on Tuesday, September 13, 1932, for the construction of highways in the following counties:

	Deposit Required
ESSEX (Bit. Mac. Pen. Method Type 2: 0.81 miles)	$ 2,000.00
QUEENS (Grading & Structures: 0.42 miles)	3,500.00
ALSO FOR THE RECONSTRUCTION OF THE FOLLOWING:	
CATTARAUGUS (Brick: 1.13 miles)	6,000.00
CLINTON & ESSEX (Cons. & Recons.) (Concrete: 1.47 miles)	13,000.00
FRANKLIN (Concrete: 1.18 miles)	2,200.00
OTSEGO (30'-36'-46' span Concrete beams; Bit. Mac. M. M. Type 3 Concrete appr.: 1.60 miles)	6,500.00
ST. LAWRENCE (Concrete: 1.98 miles)	6,000.00
STEUBEN (Concrete: 2.96 miles)	6,000.00
SUFFOLK (Concrete: 12.34 miles)	17,000.00

Maps, plans, specifications, and estimates may be seen and proposal forms obtained at the office of the Department in Albany, N. Y., and also at the office of the District Engineers in whose district the roads are located, upon the payment of Five Dollars ($5.00) for plans and proposal forms. Standard specifications are Two Dollars ($2.00) per copy. Refund will not be made on plans, proposal forms or specifications. The addresses of the District Engineers and counties in each district will be furnished upon request. Plans and proposal forms may also be seen at the office of the State Department of Public Works, State Office Bldg., Worth & Center Streets, New York City.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications, and contract agreement.

The contracts in the Counties mentioned above under the reconstruction work are Employment Relief Projects. The minimum rate for unskilled labor on these contracts shall be from forty cents to fifty cents per hour, as specified in each contract, and the minimum rate for skilled labor shall be fifty cents to sixty cents per hour, as specified in each contract. Veterans of the U. S. Military Service with dependents, where qualified to do the work, shall be given preference in employment. No person, except those in supervisory, executive or administrative positions, shall be employed for more than thirty hours in any week. Details of these regulations with respect to preference in employment, use of hand labor, hours of employment, etc., will be found in the itemized proposal.

A. W. BRANDT,
Commissioner of Highways.

STATE DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
ALBANY, N. Y.

Sealed proposals will be received by the undersigned at the State Office Building, 13th Floor, Albany, N. Y., until one o'clock p. m., advanced standard time, which is twelve o'clock noon eastern standard time, on Tuesday, September 20, 1932, for the construction of highways in the following Counties:

County	Deposit Required
NASSAU (59'—9½" Rigid Frame structure 0.04 mi.)	$3,000.00
WESTCHESTER (Concrete: 2.98 mi.)	22,000.00
ALSO FOR THE RECONSTRUCTION OF THE FOLLOWING:	
DELAWARE (100' Truss, Bit. Mac. Opt. Appro. 0.09 mi.)	1,700.00
DUTCHESS (Concrete: 3.57 & 3.74 mi.)	9,100 & 14,000
ERIE (Widening Shoulders Bit. Mac. M.M. Type 3 5.74 mi.)	7,500.00
ESSEX Cons & Recons. (Prel. Gravel Surf. & Bit. Mac M. M. O. 6.06 mi.)	22,000.00
MONTGOMERY (85' Girder, Bit. Mac. M. M. Type 3 Appr.: 0.21 mi.)	1,700.00
OTSEGO & HERKIMER (Bit. Mac. M. M. Type 3 and Concrete: 7.51 mi.)	26,000.00
SCHOHARIE (Concrete: 4.54 mi.)	12,000.00

Maps, plans, specifications, and estimates may be seen and proposal forms obtained at the office of the Department in Albany, N. Y., and also at the office of the District Engineers in whose districts the roads are located, upon the payment of Five Dollars ($5.00) for plans and proposal forms. Standard specifications are Two Dollars ($2.00) per copy. Refund will not be made on plans, proposal forms or specifications. The addresses of the District Engineers and counties in each district will be furnished upon request. Plans and proposal forms may also be seen at the office of the State Department of Public Works, State Office Bldg., Worth & Center sts., New York City.

The especial attention of bidders is called to "General Information for Bidders" in the itemized proposal, specifications, and contract agreement.

The contracts in the counties mentioned above, with the exception of Delaware, Erie, Nassau and Westchester, are Employment Relief Projects. The minimum rate for unskilled labor on these contracts shall be from forty cents to fifty cents per hour, as specified in each contract, and the minimum rate for skilled labor shall be fifty cents to sixty cents per hour, as specified in each contract. Veterans of the U. S. Military Service with dependents, where qualified to do the work, shall be given preference in employment. No person, except those in supervisory, executive or administrative positions, shall be employed for more than thirty hours in any week. Details of these regulations with respect to preference in employment, use of hand labor, hours of employment, etc., will be found in the itemized proposal.

A. W. BRANDT
Commissioner of Highways

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